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The Mentimeter and How to Use It

BY
M. R. TRABUE, PH. D.
AND
FRANK PARKER STOCKBRIDGE

WITH ILLUSTRATIONS
IN TEXT

DOUBLEDAY, PAGE & COMPANY
GARDEN CITY NEW YORK LONDON
1921

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PREFACE

THE publishers offer this book primarily as a popular treatise on the measurement of intelligence by scientific methods.

Every effort has been made to conform to the soundest scientific principles, both in the preparation of the Mentimeter tests, around which the volume is largely written, and in the introductory and explanatory chapters, in which the principles of applied psychology, as they bear upon mental tests, are stated in popular language.

The Mentimeters are based upon Doctor Trabue's experience (1) as Assistant in Educational Psychology at Teachers College, Columbia University, (2) as psychological investigator of the intellectual status of inmates of charitable institutions and of pupils in the public schools, (3) as author of various intellectual and educational scales, widely used by psychologists and educators, (4) as Chief Psychological Examiner in two of the largest Army camps, directing the intellectual examination of more than a hundred thousand soldiers, (5) as Captain in the Adjutant General's Department, U. S. Army, measuring the intellectual abilities of men in the Aviation Service, and (6) as Assistant Professor in Columbia University, giving instruction in the theory and practice of intellectual measurements and directing the application of such measurements to tens of thousands of school pupils.

Frank Parker Stockbridge, Doctor Trabue's collaborator, is an author and journalist of a high order. As managing editor of *Popular Mechanics* and contributor to the *World's Work*, *Harper's*, *Popular Science Monthly*, etc., he has been thrown into contact with important affairs in the world of science so

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that he is especially equipped to work with Doctor Trabue in presenting this interesting subject. As director of the publicity campaign of the American Library Association War Fund his contact with the Army and the results of the biggest experiment in the way of psychological tests that the world has ever seen was invaluable to him in this work. The publishers feel that the collaboration is a particularly happy one.

The success of the scientific method of testing intelligence among both officers and men in the Army has directed widespread attention to the general subject. The Mentimeter is the first comprehensive system of tests, applicable to the whole range of educational and industrial requirements, to be offered for general use.

To employers and those in charge of the selection, grading, and promotion of workers of every class, in factories, offices, and stores; to teachers of all grades, from kindergarten to university; to parents who are interested in ascertaining, and watching the growth of their children's mental development and to young men and young women striving for self-improvement and advancement and desirous of learning something of their own mental capacities and limitations as a guide to the intelligent choice of vocations or professions, the publishers offer this book in the confident belief that it will be found of real service.

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CHAPTER I

SCIENCE *VERSUS* GUESSWORK

THERE are two ways, and only two, in which we can find out what a machine is capable of doing. One of these is to try it out, to "put it through its paces" by using it for every sort of work which it is expected to perform and observing whether or not it does what we want it to do. The other way is to measure it (or to take the measurements of it as supplied by its responsible manufacturer) and compare these with the measurements of the essential parts of machines with the performance of which we are already familiar.

Unless it is a brand-new type of machine, designed to do something that has never before been done by machinery, or to do it by a different mechanical method, there is obviously a great saving of time and money in buying a machine from specifications that insure the correct performance of its expected duty over the other plan of first buying the machine and then trying it out in practice to see whether it will do what we want done.

The manufacturer or business man who would purchase machinery of any sort without first making certain that its dimensions, speeds, weight, power-consumption, controls, and the materials used in its construction were such as to adapt it precisely to the work he expected to do with it would speedily bankrupt his business. It takes but a moment's thought for the reader to prove this to himself.

On the other hand, however, we find business men constantly employing men and women to perform specific duties without

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applying any tests or measurements, other than the most rudimentary ones, to determine in advance whether the person so employed is fitted for the work he or she is expected to do. And as every employer knows, one of the most costly wastes in almost every business or manufacturing establishment is the expense of constantly "breaking in" new employees to take the places of those who have left or have been dismissed because they were found, after trial, not to be fitted for the duties to be done.

Because the installation of machinery of any kind involves an initial outlay of money, it long ago became apparent to everybody that the "trial and error" method of buying machines or other commodities was wasteful and ruinous. It was not until recent years, however, that the closer study of operating costs disclosed the fact that the expense of "labour turnover," that is to say the proportion of employees in any given business whose places have to be filled annually, is one of the heaviest avoidable drains on income. This was long overlooked because no capital investment is involved in the initial employment of labour. The cost of training new employees is much larger, it is now learned, in most businesses, than is generally understood, not only in the direct outlay in salary or wages before the new employee has mastered the duties of the new position as well as he or she is able, but in loss through spoiled materials, reduced individual output, and often in the slowing down of an entire chain of manufacturing operations through the inability of the inexperienced worker to maintain the pace of the rest of the links in the chain.

If, then, as so often happens, it is found after experiment that the new employee is not capable of performing the work efficiently, the whole process must be repeated. The employee who has failed leaves, is dismissed, or is transferred to another department, and a new and equally inexperienced worker employed to fill the vacancy, with the whole cost of training to be incurred over again. Even though the new worker may be

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experienced in the particular class of work to be done, there is an appreciable loss due to the unavoidable frictions and hesitations that occur whenever a worker is being fitted into a new environment.

There is, moreover, no guarantee that even an experienced person in a special sort of work is fitted to do that particular work as well as it can be done or should be done. He or she may have got into that sort of work by accident. That is usually the way in which a boy or girl begins a business or industrial career. He or she may have continued in it merely because the experience gained in the first job enables its possessor to pass the superficial scrutiny of foremen, managers, or others who employ "help" in the first instance. But just as all the experience and training in the world will not make a Paderewski out of a person who was not born with the precise combination of sensory and nervous qualities that the master musician possesses, though almost any one with ten fingers and an ear for harmony can be taught to play the piano after a fashion, so it is true that while in the all-important business of earning a living almost anybody can be trained to do most of the ordinary manufacturing and business operations, after a fashion, it is only those who were born with certain combinations of nerve-endings and sensory apparatus who can be trained into first-rate salesmen, or expert tool-makers. And this holds true all the way down the line, to the simplest and most automatic operations necessary in business industry.

Individuals themselves are seldom aware of their own capacities; even less generally of their own limitations. Occasionally, by accident, a man or a woman finds at the right time the opportunity to do precisely the things he or she is best fitted to do. Often the individual's strong personal instincts or inclinations lead him or her to seek opportunity to do certain kinds of work without any clear understanding why that sort of work appeals while other kinds do not. Few human beings analyze their inclinations closely. Yet it may be and frequently is the case

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that the work one most strongly desires to undertake is not that in which he or she is best fitted to succeed. The inclination may be counterbalanced by inhibitions of which neither the possessor nor his or her employer becomes aware until repeated failure has demonstrated the lack of adaptability, sometimes after it is, or seems to be, too late to take up another occupation. Then the worker usually drifts into the ranks of "casuals," constantly moving from job to job, chronically "out of work"; the ready dupe of agitators and the prophets of social unrest and revolution; disheartened, anti-social, and perennially unhappy; the most expensive sort of an employee in any position, no matter how small the wage—yet a human being, and, as such, entitled to liberty and the pursuit of happiness!

That is an extreme picture. Yet if such tragedies occur (as every reader knows from his own observation and experience they *do* occur too often) among those who have voluntarily chosen their own lines of work, how much more frequently must they occur among those whose daily occupations have been determined for them, not through any voluntary choice or intelligent guidance but solely through the accident of having been "thrown into" certain jobs when they were young?

That is the way in which the vast majority of individuals have their careers shaped for them. The world of business and industry and of the professions is full of blacksmiths who ought to be carpenters, indifferent lawyers who would have made good dentists, teachers who are failures because they should have been trained as stenographers, good cooks who have been spoiled to make mediocre shop attendants, and so on through the list of possible occupations. Within every business organization, moreover, there are grades and degrees of requirements and responsibilities into which some employees may fit perfectly, others less perfectly and others not at all, though all be drawn from the same group or from those performing the same general class of service. Here, as in the matter of original employment, the general custom of dealing with the human

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element in industry is the wasteful "hire-and-fire" system, analogous to the purchasing of machinery or equipment without first ascertaining whether it will do the work, and scrapping it when it fails.

We found out long ago that we couldn't afford to do that sort of thing with machinery. We are just beginning to find out that it is even more expensive to do it with the human element in industry.

It would perhaps be going too far to claim that the whole problem of the "labour turnover" arises from the effort to fit square pegs into round holes, but it is certain that a very large share of all human troubles, industrial unrest, discontent, inefficiency and unhappiness is traceable to the lack of proper adjustment between the man and the job, and this in turn is due in large part to the failure to determine in advance the fitness of the particular individual for the particular task.

What is needed, obviously, is a measure of human capacities, just as we have means of measuring every phase of the machine's capacities.

Just as we measure a machine by the most precise gauges and tests available, why not measure the human individual by the most precise means we are able to apply?

The word "measure" in the preceding paragraph does not mean, either in the case of the machine or of the man, the gross dimensions of length, breadth, and thickness; these are equally immaterial, in most cases, whether the subject of measurement be a man or a machine. One measures a machine to determine its *capacity* for certain work, and is little concerned about its characteristics that have no bearing upon those qualities that fit it for those particular duties. So the measurements of a human being whose capacity for certain duties is to be determined must be of those qualities which enable him or her to perform according to a certain predetermined requirement.

These qualities, in man, woman, or child, can be measured; not with the precision with which an engineer measures the

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parts of a machine that must fit within a thousandth of an inch, but with sufficient accuracy to determine quickly, inexpensively, and simply whether a given individual has the capacity to learn and perform any given task or class of work.

To explain how these tests can be made, how science can be and is being substituted for guesswork in the selection of human beings for jobs and of jobs for human beings, just as science has displaced guesswork in the selection of material commodities, is the purpose of this book.

Let us first point out clearly the difference between science and guesswork. The vast majority of jobs are filled by guesswork. The farmer who hires a field hand, the housewife who employs a cook, the foreman who takes on a new "hand" in the factory, and even employers hiring persons for more responsible positions, all do it, to a greater degree than they imagine, by guesswork. They may make inquiries, more or less thorough depending upon the compensation and responsibility involved, of persons who are reputed to know by observation something of the candidate's qualifications. Unless the individual under consideration be flagrantly and patently unfit the reports thus obtained are almost always favourable. In many cases no effort is made even to obtain such reports.

Many persons who regard themselves as intelligent employ men and women for all sorts of delicate operations and confidential and responsible relations as a result of observation alone; yet observation alone will tell no more about a man or a woman than it will about an automobile—the shape and the colouring.

When you observe a human being you can determine certain physical characteristics, such as size, complexion, colour of eyes and hair, soundness of teeth, shape of body and head, contour of face, features, and expression. You make up your mind that you like the person or you do not. But as for determining by means of anything your unaided observation discloses whether or not the person under examination is qualified either to perform or to learn how to perform efficiently a given task

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or set of tasks, you might as well expect to discover the hill-climbing power of an automobile by merely looking at it.

Yet that is precisely the way in which, in the vast majority of cases, the supremely important work of fitting individuals and jobs together is done in the world of business and industry.

True, the prospective employer usually asks a few questions, but the applicant's manner and tone of voice have usually as much to do with the final decision as the actual replies.

Men and women are usually hired, in short, on their looks and on the impressions made at a single short interview. That it is too much to expect persons so selected to fit into even the simplest sort of a business or industrial organization should be obvious to every intelligent person; that sometimes they do fit should be no less obviously recognized as largely accidental.

We do not recognize the absurdity of this method of selecting persons for particular positions, partly because this is the only way most of us have ever known and partly because there is in almost every human being a secret or subconscious belief in his own peculiar powers of judging others by means of surface indications.

The fallacy of the belief that one may arrive at accurate conclusions as to individual capacity and characteristics by merely looking at the individuals concerned has been well set forth by Prof. L. M. Terman of Stanford University. Much of the popular belief in the efficacy of this method, Doctor Terman believes, is due to the fact that the public does not know that the pretensions of the pseudo-science of "phrenology" were long ago shown to be unwarranted. According to phrenology, definite and constant relations are believed to exist between certain mental traits and the contour of the head. Phrenologists teach, for example, that one's endowment in such traits as intelligence, combativeness, sympathy, tenderness, honesty, religious fervour, and courage may be judged by the prominence of various parts of the skull. While the sincerity of Gall, the French physiologist of a century ago who invented the so-called

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science, and of his followers, is not to be questioned, the pretensions of phrenology itself have been thoroughly exploded. It has been demonstrated that traits like those above mentioned do not have separate and well-defined seats in the brain and that skull contour is not a reliable index of the brain development beneath.

"In the underworld of pseudo-science, however," says Professor Terman, "phrenology and kindred fakes survive. Hundreds of men and women still earn their living by 'feeling bumps on the head,' reading character from the lines of the hand, etc.

"But if the rating of men by pseudo-science is misleading, perhaps science is still unnecessary. It may be argued that mental traits can be rated accurately enough for all practical purposes on the basis of ordinary observation of one's behaviour, speech, and appearance. We are constantly judging people by this offhand method, because we are compelled to do so. Consequently we all acquire a certain facility in handling the method. For ordinary purposes it is infinitely better than nothing. A skilful observer can estimate roughly the height of an airplane; but if we would know its real height we must use the methods of science and perform a mathematical computation.

"The trouble with the observational method is its lack of a universal standard of judgment. One observer may use a high, another a low standard of comparison. A four-story building in the midst of New York's 'sky-scrapers' looks very low; placed in the midst of a wide expanse of one-story structures it would look very tall.

"Moreover, we are easily misled by appearances. The writer knows a young man who looks so foolish that he is often mistaken by casual acquaintances for a mental defective. In reality he is one of the half dozen brightest students in a large university. Another man who in reality has the mentality of a ten-year-old child is so intelligent looking that he was able to secure employment as a city policeman.

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"Language is a great deceiver. The fluent talker is likely to be overrated, the person of stumbling or monosyllabic speech to be underrated. Similar errors are made in judging the intelligence of the sprightly and the stolid, the aggressive and the timid, etc. Our tendency is also to overestimate the intellectual quality of our friends and to underestimate that of persons we do not like.

"If the method of offhand judgment were reliable, different judges would agree in their ratings of the same individual. When the judges disagree it is evident that not all can be correct. When intelligence is rated in this way wide differences of opinion invariably appear. Twenty-five members of a university class who had worked together intimately for a year were asked to rate the individuals of the class from 1 to 25 in order of intelligence. The result was surprising. Almost every member of the class was rated among the brightest by someone, and almost every member of the class among the dullest by someone. Doubtless the judges were misled by all sorts of irrelevant matters, such as personal appearance, fluency of speech, positiveness of manner, personal likes and dislikes, etc.

"The method of personal estimate is much better than the method of external signs (phrenology), but to be reliable it must be supplemented by a method which is *objective*, that is, a method which is not influenced by the personal bias of the judge or by such irrelevant factors as the appearance, speech, or bearing of the one to be rated. Such is the method of intelligence tests."

It would, of course, as Professor Terman points out, be absurd to contend that it is impossible to arrive at a rough estimate of an individual's capacities and character by observation, as it is absurd to pretend that accurate measurements of an individual's capacities can be made by the same method. There are men who have by long experience learned to judge on very brief contacts the possibilities of applicants for positions. Actually, what such employers do is to apply, though crudely

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and unscientifically, a limited number of tests which might fairly be classed as psychological. Out of a long experience they have accumulated an accurate knowledge of the work to be done and of the general type of individual who has been found best qualified to perform that work. This sort of ability, however, is acquired solely through long experience, and even then it can only be acquired by men or women who themselves possess certain mental qualities, which might easily be gauged and classified, the possession of which enables them to accumulate and utilize experience in this manner.

This sort of ability can by no means be transferred from one individual to another by description or by mere training. It is precisely like the ability which an experienced automobile repair man possesses, that enables him to tell by a quick inspection and after only a few minutes of observation what are the principal things the matter with a car and what service it is probably able to perform. But a repair man cannot tell anybody else how to size up an automobile at a glance, because the only way any one can learn to do it is by going through the same process of taking automobiles apart and putting them together again for a period of years. And as everyone who has ever had occasion to deal with automobile repairs is aware, the most experienced repair men are seldom positive that they know just what is wrong and all that is wrong without applying precise measurements and painstaking tests.

It is easy enough to determine that a delicate, small-boned, slender person is not the best type to employ for digging coal, loading freight cars, or other arduous manual labour. There are, of course, many classes of occupations the fitness or unfitness for which of a particular individual must be determined in the first place by that individual's physical characteristics. So far the observation method suffices. But the very fact that every industry and business is full of misfits and that it is a matter of common knowledge that the most difficult problem the employer has to face is that of finding the right person for

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each particular job that calls for anything more than mere physical strength, is the best evidence that even the most experienced and accurate observers are far from infallible in their judgments of individual capacities.

For that matter, there is no infallible test. No true scientist claims infallibility. The possibility of error is always present wherever the human element is involved. It is a safe assumption that any method or estimate that purports to be infallible is fraudulent. There is in almost every human mind a lurking, subconscious belief in the possibility of perfection. It is this which makes humanity credulous when claims of infallibility are plausibly presented.

It is extremely difficult to satisfy by logic and reason the type of mind that is strongly influenced by glittering generalities and emphatic, though unsupported, assertions. It is equally difficult to convince the skeptic whose mind is closed to the introduction of new thoughts and who, in his self-satisfaction with his own mental limitations, rejects every fact that does not tally with his preconceived ideas.

This book is written neither for the super-skeptical nor the ultra-credulous. It makes no pretension to infallibility, nor does any scientifically trained psychologist pretend that there has yet been evolved a method of measuring every dimension and capacity of the human mind beyond the possibility of error. The methods described in this book are the fruit of years of experiment, research, and practical application of the results of experiment and research, and are designed to reflect the development of the science of psychology in its application to mental measurements as closely as it is possible to do so within the limits of a single volume written primarily for the reader who has no special scientific training along psychological lines.

The reader who is not prepared and willing to examine facts and at least to take all the ascertainable facts into consideration before forming his conclusions is not likely to be interested. The scientific method of character analysis or mental measurement

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is based upon the comparison of the largest possible collection of ascertained facts. Guess work has no place in it. Psychology has small dealings with intuition and instinct nor is it in any way derived from magic or concerned with the occult. There are no unfathomable mysteries. There is no fact about the operation of the human mind which cannot be subjected to scientific investigation and measurement by any intelligent person. The scientific method requires that every conclusion must square with the results obtained by the experimental application of all related facts or be discredited as worthless. Theories have no place in science, except as something to be disproved if possible, and a single fact which does not square with any theory disproves the theory.

The scientific method of mental measurement has passed the theoretical stage. It has squared with the facts wherever it has been intelligently applied. It has been demonstrated in a wide range of business and industrial applications, in education and in its use in determining the qualities and fitness of officers and men in the Army and Navy. What it offers is the shortest, simplest, and most accurate means available of determining human capacities and qualities.

Professor Terman has admirably summarized the advantages of the scientific method of testing intelligence, as follows:

"1. It gives us a universal standard of comparison. The result is absolutely uninfluenced by the general intellectual level of the group with which the subject to be rated happens to be associated. It is like measuring the height of a house instead of estimating it by comparison with the height of surrounding buildings.

"2. It multiplies enormously the significance of mental performance. It does this by making fine distinctions which would be overlooked by the method of offhand judgment. It is like placing a smeared glass under a microscope and discovering that the smear is a complicated network of organic matter.

"3. The test method is objective; that is, free from the in-

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fluence of personal bias. It gives approximately the same verdict to-day, next week, or next year. It does not change its opinion. More important still, the verdict will be approximately the same whoever makes the test, whether a relative, a stranger, a friend, or an enemy, provided only that the rules of procedure be rigidly followed.

"4. The test result is little influenced by the subject's educational advantages. In this it differs greatly from offhand judgment, which so easily mistakes the results of schooling for real intelligence. The test method probes beneath the veneer of education and gives an index of raw 'brain power.' For example, a young woman who had been stolen in early childhood by gypsies and had spent her life with them was given the Binet-Simon intelligence test. She had never attended school a day in her life and had only learned to read by bribing a little school girl to teach her the alphabet; yet she made a higher score than the average found for two hundred high-school pupils who were given the same test.

"No wonder," Professor Terman concludes, "mentality tests have acquired such a wide vogue in the ten years since Binet gave to the world the first successful intelligence scale. In that time they have demonstrated their usefulness in the study of the feeble-minded, in the grading of school-children, in determining the mental responsibility of offenders, and in the selection of employees. Their largest and most useful applications have been in the mental classification of men in the United States Army."

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CHAPTER II

THE APPLICATIONS OF PSYCHOLOGICAL TESTS

THE intelligent reader has by this time begun to see for himself some of the possibilities opened up by the use of scientific mental tests, and to perceive their applicability in a wide diversity of fields. In later chapters specific examples of such applications are given in detail, and suggestions offered for still other uses of the tests which are contained in this book.

The usefulness of all mental tests, whether those which are offered in this volume under the general title of "The Mentimeter," or others that may be set up with equal scientific precision, depends upon, or at least is greatly enhanced, by the most complete understanding of the underlying principles on the part of the person who undertakes to apply them. The purpose of this and the next three succeeding chapters is to make these principles so plain that by the time the reader has reached the tests themselves he will have a perfectly clear understanding, not only of *what* the Mentimeter tests are but of *why* they have been put into the form in which he finds them, and of *how* their use will enable him to gauge human intelligence and capacity with a greater degree of accuracy than he has found possible by other means. If, perchance, psychologists find in this volume much that is to them elementary, it should be kept in mind that it is only through the widest possible spread of sound understanding of psychological principles that the wider application of them in the ordinary walks of life can be brought about. That, the authors take it, is the great end toward which scientific psychologists are aiming, and that is the aim of this book.

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The general purpose of psychological tests is to determine how individuals compare with one another in mental capacity, or with standards based upon the capacities of individuals known to possess certain qualities. Thus, it may be desirable, as it frequently is, to determine the relative abilities of the individuals of a certain group, like a school or college class, clerks employed in a similar form of work, a number of applicants for a certain position for which only the most capable among the candidates is desired, or the soldiers of a particular company or regiment. What is required here is a method of grading these individuals with reference to one another, by means of tests which need not necessarily have any relation to any external standard of mental perfection.

The process here is as if one were to be told to pick out of all the automobiles in a garage the best one, the next best, and so on, classifying these particular cars and no others *with relation to one another* and not with respect to any standards of automobile perfection introduced from outside. None of the cars might be perfect; perhaps the best one of the lot has leaky piston-rings and none of them will climb a 10 per cent. grade on high gear. It is a comparatively easy matter, however, to devise a few simple tests that will grade a dozen or fifty automobiles in regard to their relative ability to climb hills, carry loads, and perform the other services expected of an automobile. The one that will climb hills the best may not also be the one that will carry the heaviest load or travel the most miles on a gallon of gasolene, but out of such a series of group tests any one interested can readily determine which of all the automobiles in the group is the best general purpose car, which the poorest, and about where the others grade with reference to these two extremes.

That is about the process that a man engaged in the automobile trucking business would use in determining which one of the cars he has available is best adapted for a particular piece of hauling that is to be done. He wants to know which of his

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cars he can rely upon for any one of many different sorts of service, but he particularly wants to know all the time which of them are worth spending money on for repairs and improvements and general overhauling and which are either so poorly constructed in the first place or so hopelessly out of repair that it is cheaper to scrap them than to spend any more money on trying to make them fit for service.

In other words, the automobile owner needs to know which of his cars, however poor its present ability, has such inherent qualities as to justify the belief that it can be made more efficient by proper attention and reasonable expenditure of money.

Now, that is precisely what the employer of workers, the commander of soldiers, the teacher of a class or any one else charged with responsibility for the performance of any sort of tasks by any group of human beings, wants to know about the individuals under his direction. He should know or be able to determine readily not alone what each of the individuals can actually do and which ones can do particular tasks better than the others, but it is important for him to know the relative *capacities* of the entire group, so that he can determine, as in the case of the automobiles which have been used as an illustration, which of them are most worth spending time and effort upon in the expectation that they will learn to do even more difficult tasks, and which of them are so hopelessly incapable that nothing is to be expected of them except the simplest routine performances.

Now, the man who operates a fleet of automobile trucks does not stop when he has made a comparison of the vehicles in his garage with one another, but is constantly comparing the performance of each with standards established by other cars, machines of different makes, and with new machines. There exists, and he is constantly conscious of its existence, an ideal standard of performance for automobiles to which his cars must conform as nearly as possible if their service is to be satisfactory.

So, in measuring human capacity, it is not enough to compare

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the individuals of a group with one another, though this is essential and for some purposes temporarily sufficient; there are available standards based upon the actual achievements of individuals of known capacity by which the mental powers of any and all individuals may be gauged. It will readily be seen that the employer of a number of persons—engaged, let us say, in some specific mechanical or clerical operation—needs to know not only whether some of these are capable of being trained to do better work and some so incapable of further training that it would be cheaper to discharge them and fill their places with more intelligent persons, but also to know how any particular group of employees compares in average intelligence and how each one of the group compares in individual intelligence with the average or higher-than-average capacity of those outside of his own particular business establishment who are engaged in similar work.

This is a matter of dollars and cents to the employer. If he can obtain a standard that is universal or nearly so, that tells him, in fact, what all of the employers in his line of business have found to be the average or the limits of mental capacity possessed by workers of a particular class, then he is in a position to determine whether he is getting equally good service for the wages which he pays as is obtained by other employers requiring similar service.

To illustrate concretely: in an office employing twenty stenographers on correspondence, it is not only necessary for the employer to know which of these stenographers is the most competent and which the least and whether the less competent are incapable merely because they are beginners or because they lack the necessary mental capacity ever to become competent. He should also be able to measure the mental capacity of the entire group by some standard based upon the performance of thousands and tens of thousands of stenographers of known degrees of ability. He may discover that the most competent of his entire staff is only as capable as the average of good sten-

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ographers everywhere. Obviously, his business is handicapped by having a stenographic force which is inferior in capacity and, consequently, in accuracy, speed, and other essential requirements, to the average of stenographic office staffs in business generally. Once this has been determined, the intelligent employer will proceed to replace the stenographers who are incapable of improvement, as indicated by the tests applied, with stenographers who respond to the standard tests with a score well above the average.

So, too, with the teacher. It is comparatively easy for the teacher to classify his or her pupils into bright, stupid, and mediocre, through observation alone. What is more important, however, is to determine several things about each pupil which observation alone does not tell. Are the stupid ones really stupid or merely inattentive? Have they the necessary mental capacity to perform the assigned work of the class or are they simply lazy? Few teachers can answer this question; none with any degree of accuracy without the application of scientific tests of mental capacity. Are the bright children really bright by comparison with other children of the same age and school grade or do they merely shine by contrast with the dull members of the class? This question can by no means be answered accurately except by the application of mental capacity tests. In another chapter some of the concrete applications of mental tests in education are described at length. The point to be emphasized here is that the measurement of the mental capacities of any group should be based upon standards that will not only determine the relative capacities of the members of the group but will, at the same time, compare them all with standards that reflect the known average and maximum capacities of all others of similar age and environment.

The purpose of these tests might be summed up somewhat as follows:

To measure, by comparison with the group average or with very carefully determined standards, some of the infinite number of

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qualities and abilities, the possession of which by the individual renders him more or less susceptible to education and training or more or less capable of successfully performing certain actions requiring conscious direction from the mind.

It requires no special argument to point out how a general application of tests that disclose actual mental capacities might profoundly affect our judgment of men of all classes and walks of life. Were it possible to ticket and catalogue the whole human race in accordance with the capacity of each individual as disclosed under properly devised psychological tests, we would no longer permit the superficial absence of polish and taste to blind us to the inherent powers and capacities of the self-made man, nor, on the other hand, would we be so ready to assume that the well-dressed, fluent talker, no matter how prepossessing in appearance and manner, was necessarily able and worthy of confidence. Likewise, once such a classification became universal, it is conceivable that many business men and others who are prone to criticize the universities and their products would be more tolerant of the recent graduate, whose mental capacity is in no wise reflected by the particular variety of contents with which his mind has been filled in college.

Besides the application of scientific mental tests as already indicated, in business and industry and in education, by the employer or the teacher, there is another and important use to which standardized tests, based upon determined capacities of groups and individuals of known ability, may be put. This is the use of such tests by the individual upon himself for the purpose of determining his own mental capacity in a particular direction or of a particular kind as compared with the mental capacity of others. The man or woman bent on self-improvement or advancement may thus, within certain limits, assess by the application of standardized tests his or her own mental quality and capacity.

Again it is unnecessary to point out the advantage to the young man or young woman endeavouring to decide upon a

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career or to determine what particular course of study to pursue or line of business to enter, in being enabled to obtain an accurate gauge of his or her own qualities, powers, and limitations. Taste and inclination are no safe guides to life unless there is coupled with them inherent capacity for the competent exercise of the faculties which make the gratification of one's individual tastes and inclinations possible. Thus it may be that the individual's inclinations and tastes run strongly toward music, toward art in any of its various forms, but that physical and mental inhibitions, the presence or absence of which may be readily determined, make it impossible for the possessor of such tastes to hope to be able to perform creditably the acts which a successful artist or musician must perform.

Properly devised and applied psychological tests may conceivably disclose the existence of mental powers and capacities unsuspected or neglected because overshadowed by strong inclinations in other directions; early knowledge of the possession of such capacities may easily direct their possessors into fields in which they can thrive and prosper and achieve far greater happiness and contentment than would ever be possible through a lifetime of striving to do that for which they are not fitted by inheritance.

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CHAPTER III

WHAT THESE TESTS MEASURE

THE most natural question and one that is frequently asked is:

"What, precisely, do psychological tests measure?"

It is a question that is easier to ask than to answer.

It is simple enough to say that mental tests are designed to measure the natural or inherent mental capacity of the individual, but in order to approach a clear understanding of just what this means we must first define what is meant by the term "mental capacity."

As a matter of scientific fact, the term "mental capacity" can hardly be regarded as accurate, although it is the best term we have to describe the qualities which determine the individual's ability to perform acts requiring conscious thought. Psychological and biological science no longer regards the human mind as something different from or in any way apart from the human body. The idea that there is such an entity as a mind that operates even in the slightest degree without reference to and independent of the physical body must be dismissed, if we are to grasp clearly the principles and methods of mental tests.

To the psychologist the mind is merely a specialized organ of the physical body. The intangible something, which is what is usually meant when persons speak of the human mind, is merely the sum of all the sensations, feelings, and judgments resulting from the delicate adjustment of an almost infinite number of nerve fibres which in themselves are a part of the physical body. One may have at birth a plentiful supply or a poor supply of potential nerve endings which are ready to be

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organized and coördinated by experience and training, but unless one has the opportunity to learn from study and experience, the desirable connections may never be developed.

The maximum capacity of the mind in any particular field is, therefore, practically determined by physical inheritance of an abundant supply of nerve endings. Thus, it may be that one individual is born with two or three times as many nerve terminals connecting at the point at the back of the eyeball where the optic nerve—which is simply a bundle or rope of nerve fibres—is attached to the mechanical apparatus upon which the reflection of objects passing before the field of vision is registered. Such an individual's powers of observation are normally greater than those of the person of less fortunate heredity in this respect, whose lesser number of terminals of the optic nerve fibres limit his powers of optical perception and observation. Thus, one person may see at a glance a hundred details, all of which register sharply upon his consciousness, while another sees only the gross outlines and shadows, and in between is the average person who sees some details but not all.

It is well known to psychologists and biologists, although not generally understood by those who have not made a special study of these sciences, that mental *capacity* does not change or increase materially after the individual has reached maturity. It may be diminished through accident or disease, but the chief increase in adult life is in the volume and variety of stored-up impressions. The average girl of eighteen or boy of twenty has reached the approximate limit of his or her mental capacity. The mental tank will never grow much larger. It may be half empty or almost entirely vacant, but unless at the average age of university sophomores scientific mental tests prove the individual to be possessed of average or better than average mental capacity, it is futile to expect any great intellectual development to take place in later life.

But while the maximum capacity of the mind depends upon physical inheritance, the actual ability which is necessarily

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reflected in the scores made by a person subjected to mental tests is determined by the number and variety of nerve connections that have actually been made by environment or training. Inheritance sets the maximum limit, but as a matter of practice this maximum is never reached, or at least is so seldom reached by any individual that it can hardly be said of any human being that he has developed his mind in any direction to the utmost limit of its capacity. What we actually measure in scientific mental tests is a complex of natural or inherent abilities plus the results of education and training; because, while it is possible to a considerable extent to eliminate by properly devised tests a record of the individual's acquired knowledge, it is practically impossible to distinguish between acquired and inherent mental ability.

Note carefully the distinction between mental *ability* and mental *capacity*. Mental ability in any individual is always less than his mental capacity. If, therefore, the mental ability as determined by scientific tests reaches the highest point on the scale of measurement, whatever that may be, it follows that the mental capacity of the individual making a perfect score is even greater than the scale is designed to measure, and how much greater can only be determined by setting up new tests based upon higher standards.

The result of any scientific test simply indicates the wealth of nerve connections that are ready to be made when the stimulus necessary to their establishment is applied. It must be understood that no one having a sound claim to the possession of scientific knowledge can contend that there are tests in existence that actually measure with complete precision the inherited as distinguished from the acquired mental characteristics. It is not conceded, however, that such precise measurements cannot be made if at any time it becomes necessary or desirable to do so. For all practical present-day purposes it is sufficient that psychological tests shall measure mental qualities which are manifested by the individual's ability to express them by action or speech.

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The classification of individuals relative to one another and with reference to the possession of a particular mental ability or group of abilities is, therefore, necessarily based upon their relative ability to express in some intelligible and unmistakable fashion their mental power and qualities.

Back of this power of expression may lie hidden and undreamed-of capacities of which the individual himself may be vaguely conscious but of which he can give no outward manifestation. It may be, for example, that an individual is gifted with unusual powers of perception through the eyes, ears, and the senses of touch, smell, and taste but that he is deficient in nerve fibres and connections controlling the voluntary muscles by which human beings translate sensations into action and speech. This is hardly likely, as a physiological fact, to occur; the individual born with rich nerve endings in one part of the physical body is more likely to have a proportionate supply of nerve endings in all other parts of the body than to be deficient in one part and amply supplied in another. As rare exceptions, however, there are individuals who in infancy have, through accident or disease, lost certain groups of nerve connections while retaining unusually rich groups in other parts of the body. There is, of course, the most famous case in modern history, that of Helen Keller, whose auditory and optical nerve connections were lost through disease in early infancy, but whose unusual inherent mental capacity has been able to demonstrate itself through other and extraordinary means as a result of training and education.

But in ordinary life, if a man or a woman has some mental quality which does not express itself in an action which other persons can see or hear and know about, then it is not socially important. It is of consequence only to the individual and it is of little social service to undertake to measure these obscure and unexpressed and inexpressible capacities, as they can never, until they find means of expression, affect the individual's ability or efficiency in any occupation. It is not that these things can-

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not be measured. The case of Helen Keller is one demonstration that they can be measured. Anything whatever that makes a difference in the way different individuals act is conceivably measurable, although it may not at the present time be capable of exact calculation because it has not been worth anybody's time and effort to undertake to measure it.

To repeat, and possibly to make the preceding paragraphs more clear, let us recapitulate the different mental qualities to which reference has been made.

First, mental *capacity*. This is what the individual has inherited. It is the size of the tank into which sensations, perceptions, all that makes up the sum of knowledge, are poured throughout his life, by his education and his experience. While this capacity in the case of any individual can doubtless be measured, it is not necessary to measure it precisely but merely to determine whether it is large enough for the purposes in view.

Second, mental *ability*. This is the sum of experience and education within the limits of the individual's mental capacity. It is represented by the individual's ability to express himself in speech or action in the performance of any one of a number of specific acts. This mental ability can be quite definitely measured, and the possession of a certain degree of mental ability demonstrates the possession of a mental capacity greater than the ability which the individual has already reached.

Third, *acquired knowledge*. It is not the purpose of tests of mental capacity to measure acquired knowledge, although for many purposes it is desirable to measure the individual's acquired knowledge *in addition to* his inherent ability, and in a still larger number of instances the most practical way of arriving at a fairly accurate estimate of an individual's ability involves, among other tests, an examination into the extent of the knowledge which he has acquired through observation or training along lines definitely related to his particular occupation or pursuit in life.

The ordinary and standardized school and university exam-

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inations, civil-service examinations, etc., which have long been the accepted test of the individual's ability, do not, and do not purport to, measure anything more than this last item, that of acquired knowledge. But while certain gross dimensions of individual capacity may be roughly estimated from the results of a written or an oral examination based entirely upon the subject's stored-up knowledge, it is a matter of common knowledge, and almost every reader will be able to furnish examples out of his own experience, that such tests are frequently totally misleading. Professor Terman has reported on a comparison of the results of civil-service examinations for policemen and firemen in a California city with scientific tests applied to the individuals who successfully passed the civil-service examinations. The results were in many instances astounding. Men of such low mental capacity that they might almost be classed as feeble-minded were found to have passed with a fair degree of satisfaction the simple knowledge and physical tests set up by the city and to have obtained appointments to these responsible posts as guardians of the city's property and lives.

While it is, therefore, the object of scientific mental tests to exclude as far as possible the acquired abilities resulting from education and environment and the knowledge that has been stored up through observation and training, it is found in practice that for all ordinary purposes it is sufficient to measure a complex of native and acquired abilities. The purpose of these tests is, in short, to discover what the individual is actually able to do, regardless of the source of that ability, provided, however, that the test of ability is so devised as to make a clear distinction between mere feats of memory and the actual exercise of original thought.

Now, it must be obvious that for the measurement of anything so complex and multi-dimensioned as the human mind, no single test or scale can be established. One cannot measure the power of visual perception, for example, by the same scale that is used to measure attentiveness or initiative. As a matter

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of fact, psychologists no longer attempt to classify human abilities as narrowly as was once the popular practice. It is almost impossible for even an expert psychologist to be sure he knows just what qualities and all the qualities any particular test measures. This is because modern psychologists no longer group reactions into general functions such as memory, attention, reason, etc., but simply describe accurately the stimulus given and the conditions under which it was given and then describe just as accurately what the reaction is. The test may be built up, for example, to measure ability to recognize and classify words, but it will also depend upon ability to read the directions, ability to attend closely to horizontal and vertical lines and upon many other correlated abilities. Any test may measure primarily a particular mental dimension or ability but it is quite certain that the resulting score will be influenced by numberless other factors than the one that the examiner is most interested in measuring.

But since one of the very best tests of intelligence is, of course, the degree to which one is able to profit by social contacts and the breadth and variety of the individual's stored-up impressions, these extraneous or collateral qualities, which every test also more or less successfully measures in addition to the particular quality or mental dimension under direct examination, furnish useful data in arriving at a conclusion which is, after all, the main purpose sought, as to the individual's actual abilities and potential powers.

In order, however, to get at a really useful record of the mental capacity of an individual, we must apply a variety of tests and out of the sum total of the results of these tests we are able much more accurately to gauge the degree of possession of the qualities for which we are seeking than could possibly be done by any single test, no matter how skilfully constructed. Here again science confronts the popular human demand for a panacea. But just as in medicine only the quack offers a cure-all, so, in other fields, science has no single standard to offer by which all

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results in a given field may be accomplished, and psychology cannot now or at any time in the future pretend that by a single method or a single measurement mental capacity can be gauged.

To come back to an analogy used in a previous chapter, you cannot measure all the qualities of an automobile with a ten-foot rod. Your ten-foot rod will tell you whether the wheel base is 120 inches or more or less than that. It will not tell you how much above or below 120 inches. If it be necessary for you to know that, you must provide yourself with a longer or more minutely graded measuring implement; but because the ten-foot rod does not at a glance disclose to you all that you wish to know about a particular automobile, you do not, therefore, either discredit the ten-foot rod as a measuring implement or declare that the automobile cannot be measured except by the unaided human eye.

The limitations of the ten-foot rod are perfectly obvious to you; and so, too, are the complexities of the automobile, which require a variety of instruments and tests for their proper gauging and measurement. So before you undertake to form a judgment as to the ability of a particular automobile, you either measure it yourself or, as a matter of practice, you have it measured for you by a competent engineer. You do not necessarily inquire, if you have confidence in the engineer, as to precisely what dimensions and what materials he found in every part of the car, but you respect his conclusions, knowing that they are based upon the most precise and accurate measurements possible with the aid of such instruments as science has been able to devise, and you are satisfied that the conclusions form an accurate estimate of the machine's qualities.

The engineer who sets out to measure an automobile in all of its capacities and powers must provide himself with tachometers for measuring the engine's revolutions, dynamometers for testing its tractive force, micrometer calipers for gauging the bore and the stroke, thermometers for measuring its temperature, galvanometers for testing its magneto and battery, and hundreds of

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other instruments, the readings of which must be assembled and studied by means of complex, comparative mathematical formulas before he can tell you what a particular automobile will do.

The human mind, it must be apparent to every reader, is not less complex than the automobile. On the contrary, it is infinitely more complex and subject to an infinitely wider range of variations. As has been pointed out above, it is not necessary for practical, every-day purposes to measure every possible variation and every one of the infinite number of dimensions of any human mind in order to ascertain the individual's ability to succeed in the ordinary pursuits of life. But even in our ordinary, every-day affairs and contacts, in the simplest forms of employment, there are called into play such a number of different sorts of ability and mental power that there must be applied, if one is really to know of what a particular individual is capable, a large variety of tests of different kinds for measuring different powers. And for the mental measurement of individuals whose work calls for the highest development and capacity, a still larger variety of tests must be applied.

It is not always possible—in fact, it is extremely difficult—to devise tests that do not to some degree measure the mental content resulting from education and experience, in the effort to measure the mental capacity which limits and controls one's education and experience. The qualities that determine capacity are inherent in the individual. One is born with them or is not born with them. In their whole infinite variety they are not all possessed by any one individual, and the particular grouping of mental qualities which any one person inherits is probably not possessed by any other person living or who has ever lived. Yet while individuals differ so completely that it can truthfully be said that Nature never cast two persons in the same mold, yet there are qualities possessed by all intelligent persons, the simpler and more elemental expressions of which are absolutely essential to intelligent life and existence, and these can be so

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grouped, classified, measured, and standardized as to provide a scale whereby the inherent capacity with respect to these important and essential qualities may be determined equally in the case of the totally illiterate, untrained labourer or artisan and the highly trained, educated product of a university post-graduate course.

As a matter of practical, every-day common sense, one does not expect to find, nor does one find, except as a rare exception, an individual engaged in menial or purely physical labour who is endowed with inherent mental capacity comparable to that of the university graduate. A person possessing such capacities moves out from the ranks of labour in spite of educational handicaps; the history of American business and industry is full of the romantic stories of men who have achieved success as organizers and administrators, though in many cases absolutely illiterate. Properly applied psychological tests would pass over all or nearly all of the acquired knowledge of such individuals about their particular business and related matters, and neglect also, the bulk, at least, of the acquired knowledge of the university man, and so compare merely what might be called two naked brains, the native intelligence of each being the only thing to be measured. As has been pointed out, it is difficult or almost impossible to devise tests that entirely strip the layers of acquired knowledge from the raw mental powers beneath them, but for the practical purposes of the application of psychology and psychological tests in the affairs of every-day life, this can be done within a reasonable percentage of error.

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CHAPTER IV

STANDARDS FOR MENTAL TESTS

To TEST or measure mental capacity or any of the dimensions and powers of the human mind, two preliminary steps are necessary.

First, it must be determined what particular powers or qualities of the mind it is desired to measure.

Second, there must be prepared a standard or scale that is, primarily at least, adapted to the measurement of those particular qualities.

While it is, in practice, as has been heretofore pointed out, impossible entirely to segregate a particular mental quality or power from all the other abilities and capacities possessed by a particular individual, it is possible to select certain characteristics or abilities which, by the degree of their presence or absence, give a fair index of certain mental dimensions or capacities, and to devise tests that, when taken together, will measure these "key-abilities" and so reflect the general ability and capacity of the subject. The standards by which the results of such tests are gauged must necessarily, therefore, be such as have been shown, by experiment and experience, to give the closest possible measurement of the individual's ability in these particular directions, by enabling the examiner to compare each subject's performance under the test, or series of tests, with the records made under precisely similar tests by individuals and groups of known ability.

Mental capacity tests may be devised that will measure certain mental qualities of an infant who has not yet learned to talk, and by thus providing a comparison between this partic-

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ular child's capacities and the average of children of the same age, enable parents and physicians to determine in what direction efforts looking toward its mental development may most helpfully be undertaken. Thus we may test the infant's power of observation and perception of shapes, of colours, of sounds and familiar objects before it is able to talk, measuring these by standards derived from experience with similar tests applied to a large number of healthy, normal infants, and by this means determining whether the subject is above or below the normal average for its age and if so in what respects.

At the other end of the scale of mental development, let us assume, is the possessor of the degree of Doctor of Philosophy from any of the great universities, since this is the principal degree the possession of which tends to show the possession of unusual mental powers, if not necessarily of wisdom. By applying to a large number of Ph.D.'s tests which are designed to require for their successful performance the utmost use of all their inherent mental abilities, and arriving at an average of performance by tabulating and comparing the degrees or percentages of perfection achieved by all of the individuals so tested, a standard is set up by which to measure the mental capacity of any individual or group of individuals of superior, or presumably superior, intelligence. By such a standard there may be measured also the mental capacity of men and women who have never seen the inside of a university, but whose education has been acquired in the course of their business and professional activities. This is so because *what is measured is not acquired knowledge, but the ability to acquire knowledge*, which is quite a different thing.

The simplest way to measure the capacity of a circular tank is to pump it full of water and then measure the water as it is drawn off. But it would be absurd to contend that because there has never been any water pumped into the tank it is therefore impossible to determine how much water it would hold. And what the Doctor of Philosophy has got out of his univer-

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sity course is comparable to the water in the tank. The university may have assisted, and if its faculty were competent undoubtedly did assist him, in discovering earlier in life than he otherwise would have discovered the actual capacity of his mental tank. But there are probably as many men of equal mental capacity whose mental tanks have never been filled with the particular kind of intellectual fluid that the Ph. D. carries about with him, whose capacity there is no other means of measuring than by the application of mental tests based upon the known capacities of Doctors of Philosophy.

The process of measuring the human mind is, indeed, precisely like the process of measuring an automobile by an engineer, as was pointed out in the preceding chapter. Back of the tests that are applied to the automobile to determine its abilities and capacities there must lie a mass of very definite, exact knowledge of all automobiles or all types of automobiles already in existence and whose capacities and limitations are already definitely known. It is of no service to ascertain that the engine cylinders are of four-inch bore and that the piston has a six-inch stroke, unless it is well known what the possession of a given number of cylinders of that particular bore and stroke signifies as to the ability or capacity of an automobile engine. That knowledge has been acquired by the observation and measurement over a period of years of the performance of many automobiles of varying cylinder sizes and number of cylinders, and the comparison of each size and type with all the others.

Similarly, it is of no service to apply a test of any kind to a human being unless we have, in the first place, determined just what particular abilities or capacities we want to measure, and, in the second place, possessed ourselves of knowledge as to the significance of these capacities, after they have been measured.

Here, again, the reader should keep constantly in mind the warnings set forth in the preceding chapter and try to think of mental abilities and qualities not as detached, separate, sharply defined parts of a mental whole (as the engine, transmission and

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bearings of the wheels of an automobile are detachable, separate entities) but rather as qualities so intermingled and connected by an infinite number of attachments to all the other mental qualities and abilities that no one particular ability can be measured separately or even positively delimited by any sort of test. Even if this could be done in the case of one individual, the process would have to be repeated in each separate, individual case, as in no two human beings is there found exactly the same combination and correlation of the manifold manifestations of conscious sensation and thought that together make up the human intelligence.

But having determined just what qualities and abilities it is desired to measure, we must set up a standard of measurement by which to compare the indicated ability of each individual examined, or we shall have nothing as a result of our test but a mass of information, of the significance of which we cannot possibly be aware. This standard, for some purposes, may be merely a composite record of the performances of a particular group or class examined simultaneously and under the same conditions. That is to say, if all that is required is to determine which individual of a group has the greatest ability in certain directions (and by inference the greatest capacity for further development along similar lines) then all that is necessary is to apply a test that will give a comparative measurement of the intelligence of this particular group. But if the purpose is to ascertain how a particular individual, or the average of a group of individuals, compares in particular kinds of capacity with the average or the most highly developed persons of the same status, education, occupation, or age, then the standard by which the subject must be measured must be one derived from the observation and measurement of the mental capacities of as large a number as possible of individuals engaged in all sorts of occupations and of all degrees and grades of educational attainment. And even where the purpose is merely to determine the relative qualifications and capacities of a particular limited

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group, it is as a matter of practice desirable, it might almost be said necessary, to compare the performance of each individual of the group with a standard previously fixed and determined as a result of a much broader series of observations and experiments than can be made within the limits of any group to which it is practicable to apply any given set of tests as a whole.

This is true for two reasons. First, without such an outside standard of comparison all that is determined by the application of even the most carefully devised tests to any group is that certain individuals are more and certain others are less able in particular ways than the average of the group. The net result is of service, but of nowhere near the service of a record of the same individuals' performances graded in accordance with their approach to conformity with a universal standard. For example, one might take two, three, or a dozen automobiles on a speedway and quite readily determine which was the fastest and which the slowest, but unless one were possessed of certain standards of measurements that in themselves have no relation whatever to automobiles, the net result would be of little consequence and of no value whatever in comparing any one of these cars with another automobile that had not taken part in the particular test. In this case, two standards are requisite, namely, distance and time. The length of the course must be definitely ascertained. The time required for each automobile under test to cover the course must be accurately recorded.

Now we have a record of performance that compares at all times with universal standards. If we add another automobile to the group we do not need again to run all the cars, including the new one, along the speedway to determine where the added member of the group ranks with reference to the others; we can apply to it alone a test based upon the universal standards of time and distance with which we have already compared the others, and the new one falls instantly into its proper rank among its fellows. So, too, we are enabled by this means to compare any member of the group with any automobile anywhere in the

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world, the performance of which has been gauged by these same universal standards of time and space, and we are thus able to tell, not only how each particular car ranks with reference to the limited group of cars, but how it ranks with reference to all cars of all kinds or of a particular type so far as these have been tested by the universal standard.

So in testing groups of individuals as to their intelligence or mental capacity, the use of universal standards of comparison makes the relative grading of the members of the group with reference to each other just as easy and simple as though the only standard were that of the group's collective performance, and at the same time furnishes a record of the performance of each individual member of the group by which he or she may be readily compared with the members of any new group to which he or she may be at some subsequent time attached, and at all times with the general run of men or women of the same or differing social, economic, vocational, or educational status.

It is in the determination of these universal standards and the preparation of tests, the results of which indicate the individual's relative approximation to these standards, that the scientific training of the psychologist comes principally into play. Rough standards for testing the more obvious mental capacities might be set up by any intelligent person who would take the pains to collect the essential data. These standards would not, however, be universal unless they were based upon research and experimentation covering as broad a field as that in which the psychologists have been working for many years. Nor would they, except by accident, be as simple and as accurate as the universal standards compiled by scientifically trained persons. For just as the average untrained individual cannot form an accurate or even an approximately accurate estimate of another person's character and abilities by observation alone, so persons untrained in the study of the human mind are prone to be misled by the obvious and to lay undue emphasis upon external indications which do not, as a matter of scientific fact, actually

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signify what they are popularly believed to indicate. The scientific psychologist's training enables him to eliminate to a large extent the non-essentials and to include, in the establishment of standards of mental measurement and the preparation of tests or methods of applying these standards, many facts which, to the untrained mind, do not at once present themselves as important elements.

Even in the simplest of mechanical operations every workman knows that it is not safe to trust to the accuracy of homemade measuring implements. In the absence of a try-square made by a responsible manufacturer in conformity with the universally standard right angle, even the most expert carpenter will refuse to run the risk of error until he has either obtained a new standard from the hardware store or by the application of geometrical science and the exercise of careful and painstaking technical skill constructed for himself a new try-square that conforms, without the variation of a hair's-breadth, to the universal standard to which he must work. Still less would a good machinist undertake to gauge the close tolerances of an automobile bearing with a homemade micrometer. He knows it is not sufficient merely to have a perfect fit of this particular bearing, which might be worked out by rule of thumb, but that it is essential that the dimensions of the bearing, down to within a thousandth of an inch, must conform to the universal standards for automobile bearings, and that the best implement with which to test the degree of conformity to the universal standard is the standardized micrometer, prepared by specialized methods and produced only by the exercise of highly trained technical skill. Once given such implements of precision, any good workman can readily apply all the scientific intelligence that went into the devising of the standards and the preparation of the methods of applying them.

So, once there are at hand scientifically devised standards with which the mental qualities of any individual may be gauged and compared, and tests have been prepared for the

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scientific measurement of these qualities with reference to the established standards, the application of these tests to individuals may be made by anybody sufficiently intelligent to grasp their purport and follow directions exactly. It is not necessary, in other words, even for the testing of the most complex and highly developed mental powers, that the actual application of the test be made by the scientific psychologist. It is possible, and it has been the purpose in the preparation of the tests which are presented in this book, to devise mental tests which, if applied precisely as indicated in the instructions accompanying them, will yield the same results in the hands of the wholly untrained examiner as though the actual administration of the tests had been made by the scientist who devised them.

It must not be thought that the result of any test is always 100 per cent. accurate. Even good workmen sometimes make errors in the use of the most precise scientific instruments. Even though constructed with the most painstaking care, according to the truest scientific formulas and by men of the highest technical training and skill, the mechanical instruments of precision are occasionally found to be inaccurate. If this is the case with material implements and dimensions which are finite, concrete, and tangible, how much greater is the liability to error in dealing with the intangible, infinite, and more or less abstract qualities of the human mind. The scientific psychologist is, after all, merely another human being, and as such equally liable with all other human beings to human error. Of no man or woman can it be said that he or she is infallible, and as every one who applies a psychological test is human, and so liable to error either in its application or the reading of its result, conclusions drawn from the results of any particular test should be accepted as accurate only when they have been checked by the results of other tests applied to the same subject, and substantial conformity of the results of one to those of the others has been obtained. For this reason, among others, no single test can be expected to yield definite and complete infor-

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mation as to any particular individual's mental capacity or ability, whether gauged by the universal standard or by group comparison. It has, therefore, been necessary to establish, as preliminary to the preparation of the Mentimeter tests, a variety of standards, and to prepare a considerable number of tests under each of these standards, all or most of which must be used in each instance if anything approaching scientific accuracy is to be reflected in the resulting scores.

As has previously been pointed out, however, the scientific method is incomparably freer from the liability to error than any method of determining human ability and capacity that depends upon unaided personal observation. How completely this has been demonstrated in practice in a wide range of fields is set forth in subsequent chapters. To yield results of maximum accuracy, however, scientific mental tests must be used only with reference to the standards on which they are based.

Lest it has not been made clear already to the reader how the method of establishing mental standards of comparison operates, let us again briefly try to point out just what is meant by a universal standard of mental capacity.

It is a comparatively simple matter, involving merely a considerable amount of painstaking search and the expenditure of a good deal of time to find, let us say, a thousand engineers, each of whom has demonstrated in the course of his professional practice that he possesses unusual ability to project and design bridges and viaducts. Let us suppose that we wish to take the average capacity of these thousand engineers as the standard by which to measure every budding engineer in the technical schools with reference to the capacity of each to become a planner and designer of bridges and viaducts.

The scientific psychologist must first familiarize himself with the essentials of that combination of artistic, technical, and mathematical skill which makes a great engineer. This is not a simple or easy task to begin with, and to accomplish it calls for the exercise of highly trained mental powers on the part of the

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investigator as well as a thorough understanding of the operation of the various processes of the human mind. Then there must be devised methods by which, as simply and yet as precisely as possible, each of these thousand engineers of known capacity may be tested as to the degree in which he possesses the various abilities, the sum total of which is the measure of his capacity as an engineer. It may be necessary to make these tests over a period of years, and the tests themselves may and probably will require frequent revision and amendment as it is found in the course of their application that some of them are unnecessary and others inadequate. If it is found that any of the tests so applied is readily fulfilled by every subject examined, the effort is made to increase the difficulty of the test, until it has reached a stage where the perfect performance of all its requirements is barely within the reach of the ablest and most competent of all the engineers under examination. Indeed, some of the tests may be so difficult that none of those examined may conform precisely to the set requirements. In respect of some classes of tests this is, in fact, desirable, as what is being sought is an average of group capacity, and if any considerable percentage exhibit a capacity greater than can be measured by the tests set there arises an element of doubt as to the accuracy of the average combined score, since some of those contributing to it have obviously greater mental ability than can be measured by the particular scale used.

Once, however, tests have been applied to the supposititious thousand expert engineers, and the performance of each of them in each test has been given its proper place in the scale, and an average struck, there has come into existence a preliminary standard; which, however, before being offered for general use in the testing of engineering students and others, must first be tried out by experimental application on as many individuals and groups as are available, and their performance with reference to the standard checked up by all other means available. It may be, and quite frequently is, the case that this

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preliminary try-out of a standard results in the elimination of some of its elements, the modification of others, and the necessary preparation of a new series of tests based upon the altered standards. But in this fashion, in the course of time and as the result of the combined effort of many trained minds, there is at last set up a standard which is substantially universal in its application, and by which it may readily be determined whether or not any particular individual possesses the mental capacity and particular abilities that have been found to be necessary if he is to develop into a competent engineer.

As psychological tests are more and more widely applied and there is consequently accumulated an increasing volume of data which can be collected, classified, and compared, standards become either more firmly established as a result of experience or subject to modification in the light of the wider range of knowledge. In science nothing is final. What psychology offers to-day is a method of mental tests, the soundness of which in principle is unchallenged, though the application in detail of these principles is subject to constant improvement and refinement.

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CHAPTER V

DIFFERENT TYPES OF MENTAL TESTS

THE character of any mental test or series of tests is determined primarily, of course, by the purpose for which the test is applied, and, secondarily, by the known or obvious mental limitations of the individual under examination.

Mental tests thus classify themselves, in the first instance, into as many different classes as there are specific purposes to be served by their use, particular kinds or classes of mental ability and capacity to be ascertained, or degrees of previously known mental limitations. Each one of these classifications cuts across all other classifications at some point, so that it is, as a matter of practice, impossible to tabulate or catalogue mental tests in such a way as to separate them into sharply defined or permanently detached groups or classes.

Broadly, all mental tests subdivide at first into tests devised for use with persons of normal mental capacity and development and tests for intelligences that are not fully developed. This is, perhaps, the chief permanent and fixed classification of intelligence tests that can be made, for in a group of tests for the sub-normal mind would be included the entire series of tests adapted for the examination of the mental powers of children of all ages, from earliest infancy to maturity. In fact, the standard method of rating or grading adults of undeveloped or sub-normal intelligence is to classify them by their mental age as compared with the performance of normal children of the same age.

Thus, a man or woman of twenty-five who is able to make a high score in tests which are passed successfully by normal chil-

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dren of eight, but who fails when subjected to tests which a normal child of ten should pass easily, is rated approximately as of mental age nine.

Cutting across this classification is the arbitrary classification of tests adopted in the psychological work of the United States Army, in which every officer and enlisted man is classified as to his relative intelligence by means of scientific mental tests. The Army tests are of three principal kinds. There is a series of tests, known as the Alpha, designed to measure the intelligence of individuals who can read and write the English language. For those who are either illiterate or whose ability to read or write is confined to some language other than English, there is the Beta series of tests. These may register as high a degree of intelligence as the Alpha tests; the results are merely not expressed in terms of the English language. The third classification in the Army is the individual tests, applied to those who fail to make a satisfactory score under either the Alpha or the Beta tests. This is, in its Army application, a system of tests for the sub-normal adult intelligence. Thus the broad classification first set forth above, in substance actually holds in the classification of the Army tests.

Under each of these two broad classifications, and particularly under the first (since in general, every-day practice it is of little service to undertake to analyze minutely the capacities and limitations of the sub-normal mind except in the application of these tests to growing children) there are many possible subdivisions of mental tests, based upon the particular mental qualities which it is desired to measure.

First and most useful generally are general, intelligence tests, which must usually be subdivided into a series of related tests. Then, for varying purposes, such as the examination of candidates for particular classes of employment requiring special ability or capacity, there may be applied speed tests, accuracy tests, perception tests, coördination tests, memory tests, mathematical tests, and a wide variety of others. These are tests which

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primarily measure the subject's ability to perform certain specific acts under pre-determined conditions, the determination of capacity in excess of that actually demonstrated under test depending upon the facility and accuracy with which the subject responds to the conditions of these tests. Of course, every scientific mental test is based upon the performance of certain acts, since it is only through action of some sort, whether by speech, writing, or the performance of a manual operation, that any one is able to express his mental ability at any time.

But while it is relatively a simple matter to devise tests that satisfactorily indicate the subject's possession of the more obvious mental powers indicated by such tests as those last listed above, there is another class of mental tests, designed primarily to indicate or determine the possession of the more abstract qualities, the manifestation of which through the individual's simple and ordinary actions is less obvious to the untrained observer. This is the class of tests that are designed to measure the degree in which an individual possesses such qualities as moral sense, form perception, the power to reason from cause to effect, poetic discrimination, ability to understand complicated instructions, judgment, sense of the right relationship of things and ideas. It is as important, if one is to arrive at a true measure of any individual's mental capacity, that he be tested as to his possession of these more or less abstract qualities, as it is to determine his possession of concrete abilities. In other words, the normal mind of an intelligent adult is capable of dealing intelligently with ideas and abstractions. The mentality that does not respond with a certain degree of readiness to ideal conceptions is to that extent subnormal. The only possible way of determining the possession of unusual or super-normal mental capacity is by means of the demonstration that its possessor grasps readily and responds unhesitatingly to the presentation of abstract concepts.

The demonstration itself must, of course, be concrete. Un-

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less the individual possessing extraordinary mental power is able, as Kipling phrases it, to

> . . . . press the logic of a fact
> To its ultimate conclusion in unmitigated act.

it is of no social consequence whatever that he may possess the mental catholicity of a Shakespeare. There is no place in the modern world for "mute, inglorious Miltons."

Indeed, it may be questioned whether a "mute, inglorious Milton" ever existed. The world is full of people who regard themselves as "unappreciated." Everyone is familiar with the unfortunate type that is forever seeking sympathy, constantly on the lookout for friendly shoulders on which to sob out the sad tale of the world's harshness. Under psychological tests the preponderant majority of this type of individual is clearly demonstrated to be mentally deficient or sub-normal in some important respect. The occasional individual of normal mental capacity who fails to demonstrate that capacity by the performance of specific acts is merely mentally lazy. In other words, it may be set forth as a sound conclusion, capable of scientific proof, that mental capacity in the healthy, normal individual always finds means of expressing itself in concrete and socially useful ways, whenever its possessor actually desires so to utilize his mental powers.

In the devising and preparation of tests intended to measure the less obvious of the mental powers, a considerable degree of ingenuity and the greatest amount of scientific care and technical skill is required. To the person untrained in psychology tests designed to measure the possession of the more abstract powers frequently look childish, if not positively silly. Since it is essential, in the case of Army officers and men, to determine as nearly as it may be done by simple and easily applied tests their possession of a wide variety of mental qualities, some of the elements of the Army Alpha test appear to the concrete

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type of mind to be futile, if not absurd. But any comprehensive system of mental tests must include, as there have been included in the Mentimeter tests presented in this volume, a considerable proportion which do not on their face appear to be directed toward the disclosure of the ordinary and useful mental capacities. It is of vital importance, if the results of any given series are to give an adequate picture of the actual abilities and possibilities of the subject examined, that tests of this character be included among them.

Each of the possible classes of mental tests may be set to any one of an infinite number of standards. General intelligence tests, for example, may be set to the standard of the average university graduate, so that the result when applied to any individual gives a fair estimate of the subject's intelligence as compared with that of those who have demonstrated the possession of mental capacity sufficient to complete satisfactorily a university course. Or the standard may be that of the average lawyer, the average high school pupil, the average normal child of any age or school grade, the average skilled mechanic, the average labourer, or the average child below the age of speech. And, in practice, what is measured is, after all, general intelligence.

Intelligence, as has been frequently pointed out, while it does not depend upon the individual's ability to read and write, is so generally accompanied by the definite and intimate knowledge of the symbols which we call letters, words, and figures, and of their meaning, that in the great majority of cases in which it is desired to apply the test of intelligence this can best be done, or at least most readily be done, by the use of these familiar symbols; in other words, by tests which involve only the acts of reading and writing. If intelligence may be defined as the intellectual power of adaptation to environment, a complete test of intelligence determines the individual's ability to recognize the situation in which he finds himself, perceive his own relation to the situation, analyze it, and arrive at a conclusion as

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to what he should do next; then put that conclusion into effect by means of a concrete act. Thus one may learn a great deal about an individual's mental capacity by observing his conduct when he misses a train. But since it is not practicable to apply this method of inquiry in every case, the next best thing is to ask the question, "What would you do if you missed your train?" To ask this question of a subject is next best to seeing him in such a situation. He must exercise his sense of reality upon it, size it up and plan his reaction.

Since all life is made up of situations in which the individual places or finds himself and from which he must extricate himself, and since the broader the mental capacity, the more easily will the individual meet situations as they arise, the ideal mental test is one that presents a situation such as does or might occur in real life, and requires the subject to extricate himself, or at least to indicate his first and immediate impulse toward action should such a situation arise.

Since the purpose of mental tests is primarily to determine intelligence rather than the possession of physical qualities, it is conceivable that, in many situations, properly devised questions may give a fairer view of the subject's mental capacity than would observation of the same individual in action in a real situation. Thus a person of the highest intelligence and mental capacity might be deficient in physical courage, so that if we could observe him in action on unexpectedly meeting a highway robber armed with a revolver we might be able to deduce from his actions absolutely no criteria upon which to form a sound judgment as to his mental powers; the same subject, asked the question, "What would you do if held up by a footpad?" might exhibit in his answer unusual ability to perceive quickly and reason soundly to an intelligent conclusion—in other words, to demonstrate his possession of considerable mental capacity.

All properly constructed mental tests are, therefore, in effect, attempts to reproduce or project upon a laboratory scale situa-

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tions such as the subject is or may be called upon to meet in actual life. It is obvious that ability to analyze quickly and propound immediately the correct course of action when the situation presented is unusual and outside the range of every-day experience indicates clearly the possession of mental ability greater than is required to meet only ordinary and familiar situations. The theory of the mental test as a reproduction in miniature of actual situations is thus commented on by Daniel W. La Rue:

"It is useless to ask a savage what he would do if he missed his train, or an old bachelor what he would do when the baby cried, or a green soldier how he will behave when a shell bursts near him. Further, just which of many millions of situations are so important, or so typical, or so closely correlated with a web of others, similar or dissimilar, that they should be admitted among the select few that form a test? The answer is coming as a slow deposit from the stream of experience and experiment."

Doctor La Rue, pursuing the same theme, points out with sound philosophy the necessity for grading mental tests to fit the apparent or previously known mental level of the subject.

"We must beware how we use a high-level test to measure low-level intelligence. If our scales are set to weigh nothing less than a hundred pounds or upward, we cannot tell accurately the weight of an eighty-pound man. In particular, since devisers of tests are usually expert in the use of literary symbols, and since ordinary test conditions limit seriously the possible variety of responses open to the subject, we slide easily into the belief that a dextrous manipulation of symbols is the prime display of intelligence. No doubt it is true that in an ideally developed brain the language centres (tracts) are well webbed up with every other trait-tract. Ideally, to experience anything is to be able to utter it. But the stammering lover is matched by the stammering thinker, and there certainly may be intelligent action without the power to put it adequately into

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words. Probably Cæsar is the only great general who could describe a battle as finely as he could plan it or fight it. Words without deeds, deeds without words: we must be prepared for both. Our old test question, 'Why should we judge a person by what he does rather than by what he says?' applies to the test itself."

Because of the fact that there is a percentage of persons who, either through unfamiliarity with the English language or lack of skill in expressing themselves through word and number symbols, do not respond to tests based on the use of words, any comprehensive scheme of mental tests must contain a proportion of tests the response to which may be made without the use of written, printed, or spoken words. Of such a nature were the Army Beta tests, already referred to, and there will be found in the Mentimeter tests presented in this volume a considerable number of forms that fall into this class of tests. To the person accustomed to dealing chiefly with words and ideas, it is not always readily apparent that proof of a high degree of intelligence can be obtained by means of tests which do not employ these familiar symbols. As a mattter of practical fact, however, results which check up very closely with every other means of determining the subject's intelligence were quite uniformly obtained through the use of the Beta tests in the Army, and similar success has been achieved through the application of tests of the same general character in industry and education.

There is another general class of tests to which only passing reference need be made here. This is the class of trade tests, in which by a combination of oral examination and specific performance the precise ability or degree of skill of the subject in a given occupation or trade is determined. Although frequently confused with psychological tests, this class of tests does not properly come within the scope of mental tests in the sense of being chiefly measurements of intelligence. It has been found, however, in practice that the individual's native intelli-

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gence or inherent mental capacity has, in most occupations, a very decided bearing upon the degree of skill which he or she can attain, even in the simpler mechanical operations. Because of this fact, as well as because the value of trade tests in industry is of increasing importance, some of the principles underlying the construction of trade tests and their application are discussed briefly in a later chapter.

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CHAPTER VI

MENTAL TESTS IN THE ARMY

THE United States of America entered the World War under conditions of emergency which demanded the maximum of efficiency in the work of military preparation, with the minimum of effort. France was virtually broken; England was tired; Russia was demoralized and disrupted, and Italy was doing very little more than holding her own. The mere drilling and conditioning of the nearly three millions of men which the Nation had called to arms were not sufficient to meet the requirements of the task assumed. America was expected to develop, almost overnight, a fighting force capable of meeting and defeating a Teutonic military machine which had come to be known as the most powerful and skillful in the world.

The gravity of the situation forbade experiments with hit-or-miss methods. It was imperative that no round pegs be placed in square holes. Each one of those nearly three million American soldiers had to be placed where he would be of greatest service. Some simple, quick method of distribution was needed. It was perfectly obvious that these men could not be equally good material for soldiers or officers. Out of so great a number it was reasonably certain that men could be found especially qualified to perform each one of the particular tasks which the infinitely complex scheme of organization of a modern army requires.

It was in accordance with the law of probabilities that there would be contained in this mass of soldier material men highly skilled in every one of the more than seven hundred distinct and specific trades and handicrafts in which artisans were needed

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for the successful maintenance of the fighting forces in the field. The dragnet of the selective service system was certain to gather in its meshes men who were natural leaders and many more men who could only follow. From every city block, every cross-roads hamlet, every village street would come those who could teach and those who could only learn. It was inevitable, moreover, that in this huge aggregation of human beings there would be a percentage of the wholly unteachable, the mentally stunted, fit only to be hewers of wood and drawers of water and sure to be a detriment and handicap to any military organization whatsoever.

In a lesser degree the same generalizations applied to the human raw material admitted to the various officers' training courses; even though a fairly high minimum of educational attainment was required of all candidates, there was bound to be a wide range of military value between the best and the poorest of this officer material.

Psychology, the science that deals with the human mind, offered the only possible short-cut to the ultimate goal of the placement of every individual in the Army at the point where his efficiency would be greatest. The processes of the selective draft had weeded out the larger portion of the physically unfit. The draft questionnaire, as finally revised, provided for a rough preliminary classification of men according to their own estimates of themselves. But something more was needed—some system for passing the entire Army, officers and men, through a series of graduated sieves, as it were, so cunningly devised, and operated with such scientific precision as to tag, label, and index each and every one so exactly that as little as possible would be left for experience to disclose as to his qualifications for his particular part of the Army's job.

On April 6, 1917, the United States Congress declared the existence of a state of war with Germany. On that same date there was being held in Boston a meeting of a group of psychologists known as the "Experimentalists," among whom was

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Dr. Robert M. Yerkes, president of the American Psychological Association. On receipt of news that America was at last at war, all regular business of the meeting was suspended and those present resolved themselves into an informal committee to consider ways and means by which the psychologists of America could best serve their country.

On the evening of that day, as the result of many conferences, the president of the association asked the council to authorize him to appoint committees on various phases of applied psychology for the purpose: first, of enlisting the coöperation of every trained psychologist in America, including the entire membership of the American Psychological Association; and, second, of determining precisely what service the psychologists could best perform. The proposal met with an immediate response and Doctor Yerkes and his committee went to work.

The Army General Staff was skeptical at first, but Doctor Yerkes and his associates overcame this skepticism and by midsummer of 1917 the Division of Psychology of the Medical Department of the United States Army, with Doctor Yerkes at its head with the rank of major, was actively functioning, and the Committee on Classification of Personnel in the Army had been established and was demonstrating, to the surprise of the General Staff and the War Department, the possibility of determining by scientific means the relative military value and proper military assignment of the officers and men of the Army. By the end of 1917 psychology, as applied to war, had so far justified itself that the Surgeon General reported complete success in achieving the desired results, which he stated, concisely, to be: (a) to aid in segregating the mentally incompetent, (b) to classify men according to their mental ability, and (c) to assist in selecting competent men for responsible positions.

The programme of the Division of Psychology of the Medical Department included mental tests for all recruits during a two-weeks detention period. These intelligence ratings, as they were officially termed, aimed to aid:

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(1) In the discovery of men whose superior intelligence suggested their consideration for advancement;

(2) In the prompt selection and assignment to development battalions of men who were so inferior mentally that they were suited only for special assignments;

(3) In forming organizations of uniform mental strength where such uniformity was desired;

(4) In forming organizations of superior mental strength where such superiority was demanded by the nature of the work to be performed;

(5) In selecting suitable men for various army duties or for special training in colleges or technical schools;

(6) In the early formation of training groups within a company in order that each man might receive instruction and drill according to his ability to profit thereby;

(7) In the early recognition of slow-thinking minds which might otherwise be mistaken for stubborn or disobedient characters;

(8) In eliminating from the army those men whose low-grade intelligence rendered them either a burden or a menace to the service.

In three systems of tests in use between May 1 and October 1, 1918, in the United States Army, approximately one million three hundred thousand men were tested.

The test first applied to all, men and officers, who could read English, was known as the "Alpha." This was a group test. It required only fifty minutes and could be given to groups as large as 500. The test material was so arranged that each of its 212 questions might be answered without writing, merely by underlining, crossing out or checking. The papers later were scored by means of stencils, so that nothing was left to the personal judgment of those who did the scoring. The mental rating which resulted therefore was wholly objective.

The "Beta" test was used for foreigners and illiterates. It could be given to groups of from 75 to 200 and required approxi-

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mately fifty minutes. Success in the Beta test did not depend upon knowledge of English, as the instructions were given entirely by pantomime and demonstration. It measured general intelligence through the use of concrete or picture material instead of the printed language. It also was scored by stencils and yielded an objective rating.

Both the Alpha and the Beta tests were known as Group tests because of the large number of men to whom they could be given simultaneously. Those men who failed in the Group tests were given Individual tests in which the instructions were given by a trained psychologist working with one soldier at a time in a quiet private office. These Individual tests were of two sorts: one for men who understood English, and the other for men without education and frequently without knowledge of the English language. The Individual tests served as a check upon the Group tests which had preceded them. No man was recommended for discharge or for labour battalions until after he had been individually examined by a psychologist who spent from a half hour to an hour and a half with him, attempting to determine whether or not the results of the Group tests could be relied upon.

To determine the relative intelligence of five hundred men in fifty minutes by a method so completely objective that no part of the resulting classification is based on the individual judgment or opinion of either the examiner or any of the men themselves is certainly a practical application of psychological science. Simple as the Alpha test was, its practical working out and reduction to an exact scientific formula was the work of hundreds of highly trained minds for many months. In its concrete application it looks like a children's game, but the results are so reliable as to be almost uncanny in the precision with which they tally with the conclusions reached in the same cases as a result of long and intimate observation.

(For full details of the Alpha test the reader is referred to Appendix B to this volume.)

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The highest score a man could make in the Alpha test was 212. This is an absolutely perfect score, a correct answer or response to every one of the 212 questions or examples; but any man who made a score above 135 was given the highest possible rating. Grade A, in the mental schedule. There were seven ratings in all: A, above 135; B, which included those making 104 to 135; C, *plus*, which took in those down to a score of 75; C, for those scoring from 45 to 74; C, *minus*, for those with scores of 25 to 44; D, for the ones who gave from 15 to 24 correct answers; and D, *minus*, for those who were unable to answer correctly more than 14 out of the 212 questions.

Now for the proof! Here is an official report of one of many comparisons made between the results of the psychological tests and the actual observations and personal knowledge of men by their officers.

The commanding officers of ten different organizations, representing various arms of service in one camp, were asked to designate (a) the most efficient men in their organizations, (b) the men of average value and (c) the men so inferior that they were barely able to perform their duties. The officers had been with these men from six to twelve months and knew them exceptionally well. The total number of men rated was 965, about equally divided between the three classifications.

After the officers' ratings had been made, the men were given the Alpha test, and the comparison of results showed that the average score recorded in this test by those men the officers had graded as "best" was approximately twice as high as those the officers termed their poorest men. Of men scoring C, *minus*, in the Alpha test, 70 per cent. were those classed by the officers as their poorest men and only 4.4 per cent. of those ranked with the ones whom the officers regarded as best. Of all the men whose scores were above C, *plus*, 55.5 per cent. had been graded by their officers as their best men and only 15 per cent. as among their poorest soldiers.

In another camp 765 men of a regular infantry regiment, who

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had been with their officers for several months, were graded by their officers in five classes, according to their practical military value. Seventy-six of these men were rated either A or B by the Alpha test; all but nine of these had been graded "one" and "two" by their officers, and none of them had been placed in the lowest grade.

Out of 238 of these soldiers who scored D or D, *minus*, in the psychological test, all but eight had been placed in the three lowest grades by their officers. The psychological ratings and the ratings of the company commanders were identical in 49.5 per cent. of all cases. In 88.4 per cent. of the cases the agreement was within one step, and in only seven tenths of 1 per cent. was there a disagreement between the psychological test results and the officers' ratings of more than two steps.

Here is another comparison. Sixty company commanders each named his ten best and ten poorest privates. Without any knowledge on the part of the psychological examiners in this or in any other of the comparative tests as to the ratings the officers had given the men, the Alpha gave the grade of D or D, *minus*, to 57.5 per cent. of those picked as the poorest and placed all but a fractional percentage of 1,118 men in the same classes in which they had been placed by their officers on the basis of observation and experience.

Those who failed in the Group tests were given individual attention by the clinical psychologist. The examination here was frequently by the Stanford Revision of the Binet test or by the Yerkes-Bridges Point Scale. For men who could not understand the instructions and the language necessary for taking these two tests a series of specially devised performance tests, consisting chiefly of picture puzzles, cubes, squares, crescents, and other forms cut from wood, were provided. The assumption was that a man who has not intelligence enough to place a triangular block in a perfectly obvious triangular hole, or to piece together the six or seven parts which, when properly assembled, make up the figure of a man or a ship is so hopelessly

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deficient mentally as to be not only of no value, but a positive detriment to the Army. In many instances fully grown men with the mentality of children seven or eight years old were thus weeded out from among the recruits who had successfully passed the physical tests and been inducted into the service. Men making the D, *minus*, or E score in either the Alpha or the Beta tests were graded as of very inferior intelligence; D, *minus*, men were held to be fit for regular service but the E men were recommended for service in the development battalions or for discharge.

About 15 per cent. of all the soldiers examined were scored in the D class. They were ranked as of inferior intelligence, likely to be fairly good soldiers but slow in learning, short on initiative, requiring more than the usual amount of supervision, and unable to rise above the grade of private. Most D, *minus*, and E men were below the mental age of ten years; few men making a psychological score of D had the intelligence of the average normal fourteen-year-old boy. About 20 per cent. of the 1,500,000 soldiers examined by the psychological method made the score of C, *minus*, which indicated low average intelligence. These men were good soldiers, however, and did satisfactory work in routine matters. The C men, those of average intelligence, included about 25 per cent. of the drafted men and furnished a fair proportion of non-commissioned material.

Those in the C, *plus*, rating, which indicated high average intelligence, included from about 15 to 18 per cent. of all the soldiers examined. This group provided not only a large amount of non-commissioned officer material, but an occasional soldier whose qualities of leadership and power to command fitted him for a commission.

A man who made a score of B in the Alpha test was graded as of superior intelligence. Between 8 and 10 per cent. of all soldiers examined made the B score. This group included a large proportion of men of the commissioned-officer type and a very

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large proportion of men fit for the higher non-commissioned officers' details.

Only 4 to 5 per cent. of the men in the Army made the score of A in the Alpha test, which means that they were able to answer in the given time, correctly, more than 135 of the 212 questions in the test. These were men of very superior intelligence—indeed, of marked intellectuality. Men of this mental type who had any leadership ability whatsoever made the various grades of commissioned officers.

The practical application of the psychological tests covered a very wide range. The highest intelligence among enlisted men was required in the Field Artillery, Machine-Gun Battalions, and Signal Corps. Men of the lowest grade of intelligence served as labourers, teamsters, and in other non-combatant service, while men only slightly below the average performed the duties of an infantryman satisfactorily.

By the application of the mental tests it was found possible to bring up the average of particular companies, regiments, and detachments, by exchanging men of high mentality from one regiment for an equal number of men of the lower mental grade from another regiment in which the average of ability was low. A great saving of time and energy was made possible by being able to determine that a particular soldier, on the strength of his psychological score, was qualified to become a good artilleryman, machine gunner, or signal-corps man, or what not. If only in preventing the loading up of combatant divisions with men qualified only for the service of supply, the work of the psychologists made possible the elimination of incalculable delay in getting our overseas contingent ready to fight.

The intelligence tests used in the Army were admittedly imperfect at many points. They were especially designed for and adapted to the testing of a very much larger group than is ever likely again to be subjected to any single test or series of tests, and so, for most civilian purposes, these Alpha and Beta

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tests cannot be taken as a fair or complete system of ascertaining all the facts which mental tests ought to disclose. But at the time and for their particular purpose they functioned admirably, as all persons familiar with the result obtained will concede.

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CHAPTER VII

PSYCHOLOGICAL TESTS IN EDUCATION

JUST as intelligence tests in the Army have developed a new appreciation of the significance of analyses of intelligence as a means of selecting the right man for the right place in the military machine, so have scientifically devised mental tests emphasized the possibilities of more rapid and satisfactory progress in our educational activities.

The application of psychology to the measurement of teaching methods in institutions of learning is of comparatively recent origin. Up to ten years ago we had been able to make very little use of tests for the measurement of intelligence in schools, colleges, and universities. We were fighting blindly, as it were, to overcome the problems which faced us at every turn. We had no concrete guide, for instance, in our efforts to select proper courses of study for children and adults of various mental capacities, nor could we decide upon uniform efforts toward the disposal of such questions as vocational guidance, schoolroom procedure, juvenile delinquency, promotional schemes, retardation of children, and the proper treatment of sub-normal and gifted pupils.

The retardation problem, for example, has become serious. Statistics indicate that from one third to one half of the children in the public schools of the United States fail to advance with the speed expected of them. Ten to 15 per cent. are retarded two years or more. Five to 8 per cent. do not come within three years of the state of development set as a standard. More than 10 per cent. of the $500,000,000 spent every year in this country for school instruction purposes is used for re-

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teaching children what they already have been "taught" but have failed to learn.

Many efforts toward reform have been fruitful but disappointing. The supposition that evils in existing systems could be completely cured by adopting new methods of instruction, altering promotion methods, giving increased attention to children's health, and adoption of other innovations, was less effective, experiments have shown, than was generally anticipated by educators who put these theories into operation. These reforms were less successful than their authors expected they would be, for the reason that the reformers fell into the error of assuming that, under the right conditions, all children would be equally, or almost equally capable of making satisfactory progress. They failed to take into account the fact that there are more than two classes of school children and that they cannot be graded merely as "feeble-minded" and "normal." There are all degrees of intelligence, ranging from idiocy on the one hand to genius on the other, and any efforts toward improvement of conditions must be applied with full recognition of such differences.

There are wide differences among normal human beings in mental inheritance and these differences affect to a marked degree the capacity of men, women, and children to profit from instruction. Just as the Army had to allow for differences in mental capacity, so must the schools differentiate courses of study in such a way that each pupil will be allowed to study in a manner that is easy for him, whether that manner be rapid or slow.

Dr. Lewis M. Terman, Professor of Education at Stanford University, in California, who writes with more authority than any other author on the application of psychological tests in schools, emphasizes the fact that little progress can be made toward the correction of present evils until we acquire a more scientific knowledge of the material with which we deal. This phase of the problem perhaps suggests the only practical way toward solution.

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Intelligence tests in schools and higher institutions have been given a wide range of application, but in virtually every instance the results have justified the claim of superiority for these tests over other methods of classifying students. In some instances positively startling developments have been noted.

Of particular interest, from the viewpoint of educators who already are convinced of the value of intelligence rating in educational institutions, is the report of experiments at Public School No 64, New York City. The object was to select, group, and train a number of children of very superior intelligence, in an attempt toward the solution of the grading problem.

The experiment was suggested by a survey made several years ago by a psychologist employed by the Public Education Association. Among a number of so-called *average* children was W. H., a boy. W. H.'s mental age measured about two years ahead of his age in years. His physical development was superior to the average child of his grade, consequently he became an interesting subject to study. He was promoted as soon as he acquired the essential features of the work in each grade, and, without any conscious effort on his part, he accomplished the work of nine grades in two years. W. H. was especially fond of athletics and outdoor sports. He took his school work as a matter of course and showed no indication of special interest in books or study. By the time he had reached the fifth grade several other boys of approximately the same ability had been discovered.

One day the psychologist, the principal, and one of the assistants discussed the possibility of forming a class composed of children similarly gifted. Special classes for defective children, with a course of study adapted to their needs, had been in existence for some time. Why not organize special classes for children at the other end of the scale, composed of those showing the highest grade of intelligence? Surely these children, society's greatest assets, were entitled to progress at the

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speed that was desirable and normal to them. If defective children of ungraded classes were worthy of a course of study peculiarly adapted to their limitations, certainly an enriched curriculum must be provided to meet the needs of children whose capabilities extended to the highest degree of attainment.

The initial selection of children was made from the 5A class of W. H.'s associates, from other fifth- and sixth-grade classes in the school, and from similar grades of Public School No. 15, a neighbouring school for girls. The aim was to choose an equal number of boys and girls from four or five grades. The selection was limited to grades 4B through 6B. The basis of selection was determined by the following factors:

1—The age-grade standard was considered. Those children were selected who were below the normal age for the grade and whose school records showed a standing of general excellence for successive terms.

2—The evidence of superior ability as displayed in oral recitation during visits made by the psychologist and the assistant to the principal.

3—An analytical inspection of school record cards.

4—Two boys, H. R. and R. P., had received prizes in Wanamaker's drawing competitions. Both of these boys passed the required intelligence tests.

5—A few interesting incidents were the means of discovering some other eligible candidates.

One Sunday evening, while the teacher who later became the instructor of this new special class was visiting the Christodora House, a neighbouring settlement, the leader of the evening hour asked the children the difference between God and guard. A boy, E. R., defined the words in such concise and perfect English that the attention of the visitors became centred on him. Later he was promoted from a school he was attending to Public School No. 64 and was admitted to the class of children of superior intelligence.

E. R. was a fatalist. He told an interested visitor, who

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questioned him as to how he came to be admitted to the class, that it was fate that he was chosen. He said he had been indifferent about attending the "Children's Hour" at which his ability had been noticed, but that his brother had urged him to go. "You see," said E. R., "if I hadn't gone I might never have been chosen for this class."

A bright, aggressive-looking boy entered the principal's office one afternoon and asked the principal if he had room in his class for a "bright 6A boy." He said he lived in the district of School No. 64 and had heard there were classes for children of excellent record. His report card showed an A-A record and he was admitted. The final issue was determined by the showing of the pupils in intelligence tests devised by Dr. Lewis M. Terman, and by their social traits. Two children who had the necessary qualifications otherwise were not considered because of several unfavourable traits of character.

The foregoing instances are cited to indicate some of the ways in which children were selected for the class. The next factor considered was the choice of a teacher. It was necessary that she show high intelligence or she would not be able to attack the problems which such a class would present. The principal had no standardized test by which to measure her ability but he was guided by many of the principles of general excellence that marked the selection of the pupils.

From a group of eighty-four he tried to select a teacher who showed initiative, ability to meet new situations, both intellectually and socially, one who sympathized with and understood the orthodox training of these children, and who would lead them to follow high standards of American ideals and customs, and whose scholarship was superior, especially in language. All these virtues, in addition to a zest and zeal for the experiment, were embodied in Miss G.

The next important step was to devise a curriculum for the class, which became known as the Terman Class, because the tests used in selecting it had been suggested by Doctor Terman.

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The grades that represented the first term were 4B through 6B; the second term 6A through 7B; and the third term, 7A through 8B. Formal grammar and arithmetic were assigned sequentially as outlined in the city syllabus. The class in general studied contemporary history, based upon the World War, from newspapers and periodicals, and, whenever possible, these events were related to or associated with past history. Geography was studied in relation to history and then extended until the world geography as outlined in the course of study was acquired.

An extended amount of reading was assigned. The supplementary lists issued by Professors Baker and Abbott, of Teachers College, Columbia University; the reading list of the Ethical Culture School; and the list issued by Doctor Leland, Director of Libraries, were used as guides.

Music, drawing, and physical training were taken by the class as general exercises. These covered the grade requirements. The composition of plays, songs, and dances for special programmes also was undertaken. The privilege of observing plants and live animals, their care, habits, and manner of reproduction, was provided in the nature-study room of the school. Some of the boys were given manual training in the shops of the prevocational school after the regular session of the academic department. The class attended the senior assemblies of the school at least once a week and as many more times as the educational activities of the school permitted. The privileges enjoyed outside the classroom educated these children socially in ways that few pupils of large and congested schools may experience.

One period a week was spent in the reading and study of assigned subjects in the Tompkins Square Public Library. Children were made acquainted with all departments of the library and its facilities. Reference books, magazines, and newspapers were at their service. The children were permitted to use a club room in the Christodora House once a week for musical and social exercises. A gymnasium was at their disposal in this

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institution two periods a week, and one of the Christodora House's workers was assigned to teach the cooking club of the class. Another social worker taught a quartette of the class how to play the violin. Two boys who showed aptitude in art were given additional instruction after school at the "Boys' Club," a neighbouring institution. The class was taken on excursions to the Metropolitan Museum of Art, the New York Public Library, the Jumel Mansion, and Dyckman House—to study colonial furnishings and historical material—the Museum of Natural History, a sight-seeing yacht trip around Manhattan Island, theatre parties, campfire parties, and flower shows.

During the first term of six months *the progress ranged from one to four grades.* No pressure of any kind was brought to bear. The children were allowed to advance as soon as they acquired the work of each grade. The younger children reaped the advantage of the experience of associating with those a trifle older. This privilege perhaps accounted for the greater rate of progress by the younger pupils. During the first term the average progress was two and two thirds grades and during the subsequent terms *two grades were accomplished each term.*

The suggestion, of course, is obvious, that the general application of psychological tests of intelligence to school children everywhere would reveal similar exceptional mentalities in many schools and classes, and that we have at last, in tests of this character, an accurate method of distinguishing between mere parrot-like ability to memorize and repeat lessons and actual mental capacity. That there must result, from the wider application of the scientific method of mental measurement, a general regrading of school pupils, if not indeed a general reorganization of existing schemes and systems of education, goes almost without saying.

The use of intelligence tests for college entrance has shown satisfactory results in several institutions. In one in particular, the Carnegie Institute of Technology of Pittsburgh, a group of

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the freshman girls in the Margaret Morrison Carnegie School for Girls, was experimented on with such success that the results have been widely discussed.

All of the 114 freshmen were high school graduates. The first-year course, on which the instructors based their estimates of the students, contains the following subjects; physics, sewing, history, English, drawing and colour, hygiene, chemistry, foods, accounting, and social ethics.

Six mental tests were used, designed to answer the following questions:

(1) Can we demonstrate that we can reduce the number of students who are dropped for poor scholarship or placed on probation for poor scholarship by the use of our mental tests for admission?

(2) How do our mental test ratings of all the students compare with the faculty opinion about the general ability of the students?

The first criterion referred only to those who were pronounced as failures and dropped from college for inability to do college work, or placed on probation as doubtful students with two thirds of the regular programme. The second criterion had reference to the whole class, including the good students. A letter was sent to all members of the faculty asking them to indicate the student's general ability as compared to the general ability of the class. A list of names, with ten numbered spaces after each name, was appended. The tests which agreed fairly well with the pooled judgment of the faculty were retained. The tests which failed in this regard were either improved or cancelled. When the returns were complete the instructor's estimate was determined for each student and was used as a criterion for the tests.

The tests were analyzed both by correlation methods referring to the group as a whole, and by inspection of scatter diagrams referring to individual students. By devising a critical score it was possible to arrive at a mental-test rating. The results of

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this system of rating indicated, according to Prof. L. L. Thurstone, of the Carnegie Institute, that:

(*a*) Seven out of eleven failures could have been eliminated at the beginning of the year.

(*b*) Eight out of seventeen students placed on probation for poor scholarship should have been eliminated at the beginning of the year.

(*c*) Not one of the students who were below the critical mental-test rating was acceptable as a student. All of them should have been spared the discouragement which comes from failure and should have been advised to take up some other work.

(*d*) None of the acceptable students scored below the lower critical mental-test rating.

(*e*) All of the freshmen rated high by the faculty were above the average in the mental-test rating.

(*f*) Mental tests have been demonstrated to constitute a useful criterion for admission to college.

In October, 1918, first-year men in Brown University were given two series of psychological tests, an interval of several days separating the administration of Series I and II. Emphasis was placed upon thought and accuracy, rather than upon speed. Two hundred and ten students of the same University took the Alpha test of the Army in January, 1919. Of these men, 103 also had taken the Brown University tests, Series I and II. This made a comparison possible.

Two hundred and twelve men took Series I. Both the average and median were 66 on the basis of 100 as a maximum score. One hundred and seventy-eight men, all of whom had taken Series I, took Series II. It was administered after the students had begun military training of a rigorous nature and when they were far from fresh. The composite score of Series I and Series II, made from the records of one hundred and seventy-eight men who had taken both tests, showed that the Brown University Series proved as good as a measure of scholastic standing as did the Army test for military fitness.

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Prof. Stephen S. Colvin, of Brown University, writing on these psychological tests, says that in addition to the evidence obtained by correlating the test results and the students' academic marks, as to the relation between the scores of the psychological tests and academic standing, there is further indication that the psychological tests proved of considerable value in showing the probable success of a student in his academic work.

During the first half of the year, eighty students were reported as doing unsatisfactory work. Of these eighty students, thirteen had received a score of "good" or "very good" in the psychological tests; fourteen had received an average score: while in the cases of fifty-three the score was either "poor," or "very poor." During the second term, thirty-four men were reported as doing considerably above average grade. Of those thus reported, five ranked "superior" in their psychological tests; nineteen "very good"; seven "good"; two "average"; and one "poor."

Interesting results were noted in intelligence tests at the University of Illinois on March 6, 1919, when nearly 3,500 students, who were distributed in twenty-four different halls, were examined simultaneously. The Army test (Alpha) was used. Various members of the faculty, including deans, volunteered for special preparatory training to act as examiners and alternate examiners. It was an interesting spectacle to witness eminent men voluntarily in the rôle of students and being "tested."

In a summary of the results of the tests, Dr. David Spence Hill says:

"*The smallness* of difference between median scores of classes within each college of the large groups of students *is insignificant.* As between freshmen, sophomores, juniors, and seniors the extreme difference was less than 2 per cent. in the college of literature, arts and sciences; less than 4 per cent. in the colleges of engineering, and of agriculture; about 5 per cent. in the colleges of commerce, and less than 3 per cent. in

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the three years of the graduate school. Differences as small as these are safely to be accounted for by chance or by variations of one kind and another."

The report of the value as a whole of the intelligence test, signed by members of the University staff, says, in part:

"On the whole, the experiment performed by the energetic coöperation of nearly four thousand university people may be regarded as remarkably successful for the purposes intended. If for no other reasons, it has been worth while as a study of a device used already upon nearly two millions of men engaged as soldiers in the great historic undertaking—the World War. It has been a means of self-revelation to many persons on the campus. When the statistics are all worked out in careful detail we shall obtain new insight into some educational problems."

At Hamline University, St. Paul, Minn., the Alpha test was given to 74 men and 145 women, but reports on the results of the test are confined to 61 men and 145 women. The median for the men tested was 129 and 133 for women. The higher level for women was accounted for by the fact that there were more seniors and juniors among the women than among the men. The medians for these two classes of women were 138 and 150 respectively, but for the men in the same classes, 132 and 130 respectively. A somewhat higher standing for women was evident when the entire series of tests were considered, although the mathematical problems in the tests were harder for the women.

In questions of practical judgment, disarranged sentences and analogies, all of which involved nimbleness of wit, the women showed superiority to the men. In questions of general information, however, the men established a lead over the women, but of only 2.5 per cent.

Prof. Gregory D. Walcott, who reports the tests at Hamline, is not convinced that the Alpha tests, designed for military purposes, are the best for determining the fitness of students

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for college work. He says, however, that the degree of correlation obtained in the Hamline tests indicates that the Alpha tests are of tremendous value.

Intelligence tests are being used at regular intervals at the University of Rochester. The method of application is described as follows by Louis A. Pechstein, Professor of Psychology at the University.

"We call our freshmen to the campus a week early. The introductory week is given largely to lectures on college ethics and problems of study. During the first day of the week I give all the entrants both the Alpha and the Otis Group Intelligence tests. The marks and groupings are turned into the office and, so far as possible, we shall make up several representative classes of men supposedly of the same general mental make-up.

"During the first term we shall test the entire student body and then begin to correlate with teachers' opinions and grade records. In no sense are we committed, but we shall try to influence our programme making and section determination by the testing results. Then I shall issue a report to each student regarding his standing, apparent strong and weak processes, and try to help him in his development."

Other reports from schools, colleges, and universities indicate the widespread adoption of intelligence tests in determining the probable measure of success which a student will attain in his studies, or whether he is fitted, mentally, for the career he contemplates.

The group tests of intelligence have demonstrated their value in educational work to such an extent that, following the lead of Columbia University, a large number of prominent American universities and colleges are employing tests of intellectual ability as at least partial substitutes for the time-honoured college entrance examinations. Instead of requiring each prospective student to take an examination in which he would be required to demonstrate that he remembered the facts learned in high school, the present scheme is to examine the men who

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desire to enter college by means of the psychological tests designed to measure general fitness and intelligence. The theory behind this movement is that men should be allowed to enter college provided their intelligence and mental capacity is such as would enable them to profit by the instruction, regardless of whether such men could recall the required percentage of the facts taught them by their high school teachers.

This same philosophy will undoubtedly spread very widely through the high schools and elementary schools as well as through the colleges. A child should be allowed to undertake that work for which he is fitted by nature and intellectual capacity, regardless of what his past academic training may have been. It is unreasonable to require young men who, because of some accident, left school early in life and have continued their education through their own efforts, to go back and begin with younger pupils a course of study, which will have very little practical value to them, before they are allowed to undertake the professional courses they desire and are capable of undertaking at once. The group-examination method, which is employed by the majority of the Mentimeter tests, has been the greatest possible stimulus to the employment of intelligence examinations, because of the great saving of time which it affects over the method of individual examinations.

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CHAPTER VIII

MENTAL TESTS IN INDUSTRY

THE case for scientific mental tests as a prerequisite to the employment of beginners in business and industry has been well put by Dr. Henry C. Link. In addressing a convention of California railroad men, Doctor Link said:

"Would you, gentlemen, enter into a contract to buy material from a concern, the excellence of whose product you had grave reason to doubt? Would you place orders to the extent of three and one half millions of dollars a year, waive inspection of material, accept whatever was offered you, and make no effort to get your money's worth? You would not—not if you expected to hold your job. And yet, that is what you are doing with respect to the public education system of California. In 1916 the railroads of this state paid in operative taxes $7,151,583. Of this sum 51 per cent., or $3,647,300, was used for purposes of public education.

"*The boys and girls sent you from the public schools you take into your service, sometimes after a perfunctory mental examination, generally with none;* in other words, *you waive inspection,* and then complain of the character of material after it has reached you and been paid for."

It is, of course, in the case of the untried beginner in business or industrial life, the boy or girl fresh from school who has as yet had no opportunity to discover or to demonstrate his or her ability or capacity, that the application of scientific mental tests is most essential.

The skilled worker of long experience, master of his craft or of one or another of the specialized mechanical operations that

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enter so largely into modern industrial processes, has already found a definite place in the scheme of things and a simple trade or performance test is all that is required to indicate where that place is. For the present, at least, we are concerned with the worker of this class only long enough to point out, in passing, that a generally adopted scheme of intelligence measurement might have disclosed the possession by any individual of this group of abilities that would have given him a broader field and a happier and more useful existence, had he and those responsible for giving him a start in life been made aware of them early enough. Even to-day, when he has been engaged in his narrowly limited field of work for the better part of his active working life, he may have latent or undeveloped mental capacity such as would qualify him for more important, better-paid employment were some means provided for disclosing its existence.

There is, in fact, no degree or kind of employment for which a more intelligent and satisfactory selection of employees cannot be made by means of properly devised mental tests, accurately applied, than by any other method now in use. Under the direction of Dr. Walter Dill Scott the Carnegie School of Scientific Salesmanship of Pittsburgh has demonstrated the usefulness of the scientific method when applied not only in the selection and training of salesmen but for the choosing of men qualified for the most important executive positions in large industrial and business establishments. A large number, possibly as many as a hundred, of the largest industrial corporations of America have already (1919) adopted in whole or in part some system of scientific mental tests for the classification and grading of present employees, the selection of new employees, and the filling of vacancies by promotion. It is the unanimous testimony, whenever a properly devised system of tests has been applied in accordance with scientific methods and without prejudice, that the actual saving in time and expense as well as in the disorganization resulting from a heavy "labour turnover" has in every

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case been highly profitable from the employer's viewpoint, while it almost goes without saying that the benefit to the employee in being accurately placed in the position in which he is best fitted by his natural mental endowment and capacity to function makes for individual contentment and satisfaction and for steadier and presumably higher earning power than the old hit-or-miss method could possibly do.

Next to the beginner in industry or business, the boy or girl starting his or her vocational career, the class to which the application of scientific mental tests is of the greatest benefit to employer and worker alike is the large group of unskilled, untrained workers, men and women of no particular trade, the "floaters" and seasonal workers, who turn their hands to whatever employment opportunity offers without developing especial skill at any one recognized trade or occupation.

In our modern industrial system, a very considerable part of the personnel of our factories, shops, and stores consists of this class of untrained workers. They try their hands at many things and fail in most. They constitute the majority of those who respond to "Help Wanted" advertisements and are willing to try any sort of work; their chief occupation in life is hunting for jobs.

This need not remain forever true. Because there is not in general use any intelligent or accurate method of determining whether or not any one of these unskilled, untrained workers possesses the elementary mental capacities requisite for a particular sort of employment, it is not surprising that most of them fail to make good in the jobs into which they are indiscriminately shovelled. Yet the great majority of them do possess mental capacity of a nature and degree which, once it is ascertained, indicates their definite fitness for some particular sort of work no less than it does their definite unfitness for many other kinds of work which they are prone to undertake.

Just as war conditions brought into the Army an enormous mass of young men whose capacity and special abilities had to be

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determined by scientific tests before they could be assigned to the places where they could most usefully serve in the military scheme of things, so the same exigency of war brought into the industries of the country, largely centred upon the production of munitions of war, millions of women without industrial experience or vocational training but upon whose efforts the nation had mainly to rely for the output of weapons, ammunition, military equipment and accessories without which the Army and Navy could not have functioned. In a large class of plants engaged in munition production the chief demand was for sufficient muscular strength, with a slight modicum of intelligence, for the operation of automatic machinery. But in the vitally important work of inspecting, testing, and sorting the finished product of even the most highly perfected automatic machines and in many of the more delicate operations of assembling and adjusting devices and apparatus made up of a number of more or less complicated parts, intelligence and mental capacity of several different kinds and ranging up to fairly high degrees were called for.

In a number of the larger munitions establishments scientific mental tests were adopted for the selection and assignment to particular tasks of the women workers. Wherever this was done it was found that the output was increased, a higher average of quality maintained, and the labour turnover greatly reduced.

In one of the largest groups of munitions plants at Bridgeport, Conn., there was worked out, under the direction of Dr. Henry C. Link, a system of scientific mental tests which checked up so closely with the actual results obtained by the most skilful workers that their adoption for the examination of all applicants for these positions resulted in very definite time and money savings and increase in plant efficiency.

Two types of work, conducted side by side in the same room, were settled upon as the most fruitful fields for the first experiment. The work chosen was that of inspecting

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shells before they had been loaded, and of gauging them for head-thickness. This work was being done by 330 girls, two thirds of whom were engaged in inspection and one third in gauging.

The work of inspecting shells was done at a table constructed like an upturned, shallow box. Upon this table was dumped a large box of brass shells, not yet loaded, and all of exactly the same kind. The work of each girl was to inspect these shells and throw out those that were defective. A girl would first gather up a handful of shells, being careful to have them all pointing in the same direction. Then she would put both hands around the shells and turn them up so as to expose their insides. She would then look down into every shell for dents, scratches, stains, and other very minute defects. When any such defect was discovered the shell was extracted from the pile and thrown into one of three or four "scrap" boxes. The entire handful was then turned over and the head of every shell examined for various defects. The shells were then held in a horizontal position on the left hand and allowed to roll from the pile into the right hand. Each shell, in rolling, exposed its lateral surface and was closely scrutinized for scratches, dents, oil stains, and other defects. The good ones were taken in the right hand and dropped into a pocket at the right side of the table, through which they fell into a box below.

This operation required good eyesight (in order to distinguish defects, which frequently were so minute as to be indistinguishable to all but the best of eyes); keen visual discrimination (the ability to determine, with a few glances, which shells were defective); quick reaction (ability to extract, as quickly as seen, the defective shell and toss it into the appropriate box); accuracy of movement (ability to pick out the right shell from a closely held handful); steadiness of attention (ability to prevent bad shells from slipping by or unduly lengthening the operation).

A set of eight tests was selected for the body of the experiment.

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The first was a simple eyesight test. The second was a card-sorting test. The subject was given a pack of 49 cards, upon the face of each one of which from 7 to 12 letters were distributed promiscuously. Twenty of the cards contained the letter "O" and the rest did not. The subject was asked to sort these into two piles, those which had "O" on them and those which had not. The time required for this performance was taken and the number of errors recorded. The object of the test was to bring out the subject's ability to pick out the essential element from a more or less heterogeneous collection of elements, and also, in some measure, to bring out the deftness of the subject in handling cards.

The third test was a cancellation test. The subject was requested to cross out, with a pencil, every 7. The fourth was a simple "Easy Directions" test. The fifth was a number-checking test, in which the subject was asked to place a check opposite every group which contained both a 7 and a 1. The sixth test was a tapping test, in which the subject was required to push down, as rapidly as possible, a telegraph key to which was attached a counter. The number of recorded thrusts over a period of one minute constituted a record for that performance. The seventh test was an accuracy test. This was given with the aid of a brass plate with nine holes, graduated in size from $\frac{1}{2}$ inch to $\frac{1}{8}$ inch in diameter. The subject was asked to take a brass-pointed pencil and insert it into each hole, beginning with the largest and continuing through the smaller ones, until the pointer touched the brass side of one of them. The brass-pointed pencil was wired in circuit with the brass plate containing the holes so that, whenever the brass point touched the side of the hole or any part of the brass plate, an electric contact was made which produced a click in a telephone receiver which the subject held to her ear. At the start of the test, the subject was instructed to put the brass pencil into each hole in succession until she heard a click in her ear, when she was to start all over again. The speed of the subject's movements was control-

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led by a metronome, so as to allow thirty trials per minute. This test occupied from two to three minutes.

The eighth test was a steadiness test. This consisted of two brass bars about twelve inches long, set so as to form a long, horizontal V. The subject was asked to take the brass pointer and pass it along between these two bars. The farther she went, the narrower became the space between the bars. As soon as the brass pointer touched one of the bars it produced a click in the telephone receiver. The point at which this brass pointer touched was then read on a scale on the lower bar. Each subject was given fifteen trials and the last ten were averaged and constituted the subject's average.

These eight tests were given to seventy-three girls, fifty-two of whom were inspectors and twenty-one gaugers. The scores in the tests were compared with the average daily work of the girls. This average was obtained by recording the number of pounds of shells inspected by the girls and the number of hours required for the work. It was found that the inspectors who inspected the largest number of shells in a given time attained the largest scores in the tests, thereby indicating the value of the tests in determining whether an applicant for work as an inspector had the mental capacity for the work.

The same tests were given to the twenty-one girls engaged in gauging the head-thickness of shells. This work does not require the use of the eyes. The operator simply picks up a handful of shells and, with or without looking, tries the head of each shell on a gauge. The gauge is a piece of steel with two notches or openings. The shells which are too small pass through the first opening and fall into a box of rejects below. Those that do not fall through are tried on the second opening and, if they pass through, they are of the right size. If they fail to pass through they are too large and are thrown aside. The operator sits in front of her gauge and tries each shell at one opening and then another, just as rapidly as she can move her hands up and down.

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The tests showed, in this instance, an entirely different set of correlations. The comparative correlation scores follow:

TESTS	INSPECTORS	GAUGERS
Card Sorting	.55	.05
Tapping	.14	.52
Cancellation	.63	.17
General Intelligence	.14	.18
Number Group Checking	.72	—.19

Perfect agreement between average daily work and score in the test would be indicated by a correlation score of 1.00, while lack of relationship would be indicated by a correlation of 0 or nearly 0.

The score of the gaugers in the tapping test (.52) showed that they were speedier and had greater endurance. This seems reasonable since, in the operation of gauging, speed of movement and endurance are the chief factors. In the visual discrimination tests, such as card sorting, cancellation, and number group checking, the scores of the inspectors were higher. This quality, however, was not necessary to successful operation in gauging.

In other operations the results of these tests proved their value as a factor in eliminating blunders in the employment office. Girls who seemed, from observation, to possess the very qualities necessary for one or another operation, frequently puzzled their superiors by their failure to perform some highly important operation of their work. The eight tests would have demonstrated this particular inability and would have saved thousands of dollars lost through delay and mistakes. Similar results were obtained in experiments with men workers.

In almost every industrial enterprise, clerical work of some kind or another is necessary, and a problem of universal interest has developed around the selection of clerks. The time required to "break in" new employees runs from two weeks to two months, according to the nature of the routine, and this process

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invariably is very expensive. By means of standardized mental tests the whole process may be greatly simplified.

In an experiment recently reported tests were given to fifty-two men and women engaged in clerical and near-clerical work. An aggregate number of 440 tests was given. The manager of the department had made a study of these people and had attempted to rate them as to their actual ability.

The tests were classified under the head of tests for *technique* and tests for *intelligence*. By *technique* is meant the speed and accuracy shown by clerks in sorting tickets and papers, posting and adding columns of figures, indexing and filing, and in other routine clerical operations. The term *intelligence* is interpreted to designate the facility and success with which a clerk could master new tasks and follow directions about new work assigned from time to time. The clerk's *technique* was indicated by steadiness, arithmetic, card-sorting, and substitution-of-letters tests. The *intelligence* tests included a "hard-directions" test and an "abstract-relations" test, similar to those given in the Mentimeter in this volume.

When all the tests had been given the results were computed and tabulated so as to bring out the following points: (1) the rank of each individual with reference to all the rest; (2) the relation of each of four groups to each other; (3) the relation between technique and intelligence. The results were then submitted to the office head, who compared them with his records and with his own opinion of the relative merits of the various individuals. This comparison showed a very marked agreement between the testimony of the tests and the rankings of the office manager.

The results of these tests so impressed the office manager that he decided to give them to all incoming clerks. One of the first candidates to be examined was a young woman who had recently been interviewed by one of the office heads. The candidate was so unprepossessing in appearance that in spite of signs testifying to her intelligence, the office head was in doubt as to

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the advisability of hiring her. The psychological tests were applied. When this was done the young woman did remarkably well in every test. She was then hired, and proved herself so ready and capable that it was decided to train her for the work of an office assistant. In six weeks she had mastered the routine of four different kinds of work. This was a striking instance in which the testimony of the tests belied the testimony of observation.

Although there were certain inadequacies in the tests applied, as well as in the judgments obtained from office heads, the value of the results became more and more clear with each passing month. For example, 188 clerks recommended on the basis of the tests and followed up at intervals of one month for a period of three months were estimated as follows:

Percentage of those called good by their superiors

At the end of one month	75%
At the end of two months	89%
At the end of three months	92%

Another series of interesting experiments to determine the mental capacity of workers in industry was directed at stenographers, typists, and comptometrists. The work of these kinds of workers has been specialized by the use of a standard machine, and in applying tests to this kind of work it was necessary, therefore, to take into consideration two important factors: first, the skill already acquired by the workers at a certain machine; second, the aptitude which the worker possessed for improvement in the use of the machine.

Relevant tests were given to two senior classes of more than three hundred girls and boys in a commercial high school, to seventy-six pupils in two business schools, to a group of twenty-two office typists, to another group of nineteen stenographers, to over four hundred candidates for positions as typists and stenographers, to three groups of more than one hundred and forty comptometrists; and finally, to more than one hundred and twenty candidates for comptometry. More than one

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thousand persons were tested and more than five thousand tests were given.

Tests for typists included copying, spelling, substitution, and the Trabue Completion test. In the copying and spelling tests, office forms were used. A number of words, purposely misspelled in characteristic fashion, were mingled with words correctly spelled, and the applicant was asked to check off those incorrectly spelled. It was discovered, in the substitution test, that if an applicant without much previous experience in typing does very well in the test, the indication is that she has the necessary aptitude or potential ability to become a good typist with practice. The success of the applicant in the Trabue Completion test indicated his or her ability to complete sentences parts of which are missing. The ability to do this is a great advantage to the typist and one which will increase her capacity.

The Trabue Completion test also proved valuable in determining the ability of stenographers. The most important test probably, for a stenographer, is of her ability to take and transcribe dictation. Tests were given as nearly as possible at the speed which was best adapted to the applicant's ability. The results were then graded on the basis of the total time consumed and the amount of work done correctly.

In experiments for determining the ability of computing-machine operators various tests were used. One of the most important was a mental-arithmetic test. This was designed to determine the applicant's fundamental knowledge of arithmetic. Another was a numerical substitution test. In each of the tests conducted the scores of the applicants were compared with the rankings made previously by department heads, and in most instances there was an agreement of sufficient approximation to indicate the value of the tests.

Although still in its infancy, as it were, so far as its practical application in industry goes, the scientific method of mental measurement, wherever and whenever applied in accordance

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with true psychological principles and by standards and methods devised by trained psychologists, has so completely demonstrated its economic value and social usefulness that its general adoption, as these facts become more generally known, seems inevitable.

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CHAPTER IX

HOW TO USE THE MENTIMETER TESTS

THE Mentimeter tests differ from the Alpha tests, or from the Beta test of the United States Army, from the Otis test, or from any other system of tests now available, chiefly in their flexibility. Rather than present to the public a certain fixed and invariable group of eight or ten tests which are to be used wherever a measure of general intelligence is to be employed, as has been done in other cases, the present authors have chosen to present a wide variety of tests from which each reader may select those for his use which actually give the best results.

It is not probable that exactly the same tests would select men of high intelligence in the graduate work of a university as would be needed to select the intelligent men in a logging camp in the wilds of Canada or our own Northwest. The present authors do not profess to know just how much of each mental trait is required to make up a perfect superior intelligence, and for that reason they have not attempted to propose any single group of tests as the best measure of intelligence. The reader is asked to "try out" such tests in the Mentimeter series as seem to him to offer greatest promise of usefulness, and then to make up his own "team of tests" in such manner as will best reveal the kind of intelligence in which he is interested.

For the benefit of those who wish some suggestions as to the tests which would probably be most useful in the main lines of work to which intelligence tests may be applied, the authors here propose certain tentative or suggestive lists which would seem to them to offer great promise of successful use. For the

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classification of clerical workers in business and industry, the following tests should at least be given thorough trial:

MENTIMETER NO.	TITLE	MENTIMETER NO.	TITLE
6.	Completion of Form Series	16.	Naming Opposites
7.	Checking Identity of Numbers	23.	Completion of Sentences
8.	Digit-Symbol Substitution	24.	Analogies
9.	Completion of Number Relation Series	28.	Arithmetic Reasoning

It is possible, of course, that some employer who makes the trial will find a half dozen other tests that show more accurate results in classifying clerical workers than will be shown by any test in the above list, but such a thing will probably not happen, for the type of test which has been useful in similar situations will probably prove useful again. If such a thing did happen, however, the employer would be foolish and unscientific to retain the list suggested above when he knew of a better list.

In the classification of the intelligence of labourers, the authors would suggest that the following tests be given fair trial:

MENTIMETER NO.	TITLE	MENTIMETER NO.	TITLE
2.	Pictorial Absurdities	9.	Completion of Number Relation Series
3.	Maze Threading	18.	Range of Information
5.	Dividing Geometric Figures	28.	Arithmetic Reasoning
6.	Completion of Form Series	29.	Practical Judgment

For classifying public school pupils according to their general intellectual power and ability to learn, the authors propose that the following tests be employed until a different selection has been proved to be superior:

MENTIMETER NO.	TITLE	MENTIMETER NO.	TITLE
2.	Pictorial Absurdities	20.	Reading Directions
3.	Maze Threading	23.	Completion of Sentences
8.	Digit-Symbol Substitution	28.	Arithmetic Reasoning
16.	Naming Opposites	29.	Practical Judgment

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As being more strictly education tests rather than tests of intelligence the reader's attention is invited to the following list:

MENTIMETER NO.	TITLE	MENTIMETER NO.	TITLE
10.	Addition	25.	Handwriting
17.	Spelling	26.	English Composition
19.	Reading: Vocabulary	27.	Poetic Discrimination
21.	Reading: Interpretation	28.	Arithmetic Reasoning

The most profitable list from the point of view of social entertainment would seem to be the following:

MENTIMETER NO.	TITLE	MENTIMETER NO.	TITLE
2.	Pictorial Absurdities	22.	Disarranged Sentences
3.	Maze Threading	23.	Sentence Completion
5.	Geometrical Figures	24.	Analogies
6.	Completion of Form Series	27.	Poetic Discrimination
18.	Range of Information	29.	Practical Judgment
20.	Reading Directions	30.	Logical Conclusions

Whatever the purpose for which the tests are to be used, the best results can be obtained only by securing from the original publishers the carefully printed forms prepared by the authors of the tests. Mimeographed copies of test blanks or privately printed blanks are certain to differ so much from the true form that the results obtained therewith cannot be directly compared with the official results.

Long experience has likewise demonstrated, fairly clearly, that the best results will be obtained in any industrial organization or educational staff by making one person chiefly responsible for the proper administration of the intellectual and educational measurements. If a personnel director is at hand who can study his tests just as scientifically as he studies his men, progress and improvement in the methods and results are inevitable.

Measurements of intelligence are by no means the only or final criteria by which the successful personnel manager wins success

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in his work and saves money for his employers. He makes use of every piece of information about his men that it is possible for him to pick up anywhere. The trade tests particularly offer a wide field in which measurements of intelligence may be supplemented and made more useful. Of two men who are to-day working in the same trade, receiving the same wages and making the same score on their trade tests, that one is more promising who has the higher intelligence score. On the other hand, of two equally intelligent men, as measured by the intelligence tests, that one who has attained within a given time the higher proficiency in his trade is superior.

The chief value of the group intelligence tests will probably always be in the classification of large groups of persons into smaller, well-defined groups, the members of which groups may then be studied more carefully and by more exact methods in the hands of a trained psychologist, if necessary. Until the group method of examination was developed, making it possible to test the intellectual ability of every employee without tremendous expense in time and money, it would have been most foolish to talk about maintaining a continuous inventory of the mental strength of an organization, and yet such an inventory is now possible—just as possible as the record of the condition and capacity of each machine owned by the company.

Prospective users of the Mentimeters need to bear in mind that mental powers are far less constant in their amounts than are the dimensions and measurements of a piece of steel or lumber. Even the length of a steel rail varies between winter and summer, but the variation that occurs in the strength of mental connections from day to day or from hour to hour is very much greater than the variations of the steel rail. Except by chance one would not obtain exactly the same score a second time in taking a Mentimeter test, or any other test of mental ability. Being for the most part constructed on the "increasing difficulty" plan, however, the Mentimeters will prove much less influenced by recency of drill and nearness to the lunch hour

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than will most other tests, especially less than those speed tests which measure how many simple tasks one can do within a given time limit. The Mentimeter ideal is to test power rather than speed.

No single set of tests should be used as final and conclusive in the public schools with regard to the kind of work which a given boy or girl should undertake. The Mentimeter tests may be used as a first "drag-net," but those caught in this net should then be carefully studied by the most refined methods known to psychologists before being recommended for particular types of special instruction or sent to special schools. One of the most hopeful signs in the entire educational field is the number of cities that are employing psychologists to follow up the results of group examinations in the schools. Many of the state universities have established bureaus to serve the local communities* in such matters. The very finest measurements are of no avail unless something is done about the results disclosed.

For each of the Mentimeter tests, the authors have classified the possible scores into five general groups: Superior, High Average, Average, Low Average, and Inferior. This classification is very rough and should not be wrongly interpreted. An individual who is tested with three or four or more of the Mentimeter tests should not be expected to receive the same classification in each test. In the Handwriting test, for example, a person might well be expected to make a rating of "Superior" in *quality* of writing while making only "Low Average" in *speed* of writing. The same person might well make a score on the test of Poetic Discrimination which would classify him as "Inferior." Although there is a tendency for people who are superior in one line to have high abilities in other lines, it

*There has recently been established in Teachers College, Columbia University, New York City, a Bureau of Educational Service, the Director of which would be glad to answer questions or advise with any one interested in measuring intelligence or educational results, regardless of the state or community in which one may live.

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is only a general tendency, which will not hold good in all cases and with regard to all varieties of ability.

For the most accurate scientific work the reader will probably disregard entirely the fivefold classification of scores mentioned above. The finer distinctions made by the numerical scores will be studied, and interpretations will be made for the specific purposes of the examiner. It is probable, for example, that comparatively few children at the age of eight years would be classified as being better than "Inferior," if these rough general classifications were to be the only record kept of performance on these tests. On the other hand, very few clerical workers of proved ability and success would make a classification as low as "Average," except possibly in a few specialized-ability tests. The important point to be considered by the teacher of a second-grade class, or by an employer of clerical workers, or by any other person who wishes to make serious use of these tests, is the relation of the scores in the test to the relative abilities of the persons in the special group tested. The tentative classification of scores made at the end of each section of the chapter which follows this is for human beings in general and will not fit well any specialized group of persons.

In order to assist readers who have no statistical training in the evaluation for their special purposes of any particular Mentimeter test, a few pages will be devoted to an elementary statement of how to try out scientifically the relationship between a test, on the one hand, and demonstrated ability in any special line of endeavour, on the other. It may be stated here again that not all traits of mind are important in every task that must be done in life. Some positions require only a little intellectual ability while others require a great deal, and some tasks require very great development of a few traits which may be very little called for in other equally important tasks. The authors have used their best judgment as to which tests will probably select the type of persons needed in a certain type of position, but the judgments of other equally experienced men would be just as

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good. The final proof of reliability in a test can come only by actual trial of that test upon men of various degrees of demonstrated ability in the trade or profession concerned. What follows is a statement of how to measure this correspondence between demonstrated degree of success and score in a test, or between the scores of the same persons in two or more different tests.

No measure of relationship between success in life and success in a test can be any more accurate than the original measures of success from which the calculation is made. If the measures of success in life are unreliable, then the measure of their relationship to success in a test will be even more unreliable. The more definite and certain one can be of his measures of success, the more reliable will his measure of relationship be.

In productive labour, especially where payment is based upon the number of standard articles produced in a day, or upon the number of standard operations performed in a given time, the records of actual performance are probably the best measures of success available as a standard against which to judge the reliability of a test. The record for one day or for one week would be less reliable usually than the record for a month or a longer period.

In many business organizations and industries there is no such satisfactory standard of success as individual production records, and in such cases it is necessary to make use of the judgments of foremen, supervisors, or superintendents. These are far less satisfactory records of efficiency and are subject to gross errors and prejudices, but they are the only available measures of many workers. If the rating as to ability is the consensus of the judgments of two or more supervisors, each making his rating without any reference to that made by any other person, the result is much more reliable than the rating of any single supervisor would be.

Very grave errors creep into a rating of efficiency where the ratings are made by different supervisors, each supervisor rating

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only a few men. Even where a detailed schedule of qualities is listed, each to be given a definite weight or importance in making up the total rating, as in the Army Rating Scale, the degree of ability which one man's experience leads him to call "Average" will call forth a rating of "Superior" from another equally able supervisor whose experience has been with slightly different people. If individuals A, B, and C are rated by the first supervisor and individuals D, E, and F by the second, it is not at all safe to assume that C is rated fairly in relation to D. Only when two individuals are rated by the same supervisors upon the same scale and under the same conditions is it legitimate or safe to assume that their relative abilities are well indicated by the ratings.

Assuming that the reader has obtained a reliable order of merit for the individuals he is using as a check upon the value of the Mentimeter tests, no test should be considered useful which does not result in approximately this same order of merit. The tests are, of course, so short and so crude that it is not to be expected that any test will, except by chance, show exactly the same order of ability as the production records or supervisor's ratings furnish, but some tests will show much closer correspondence than others. Those tests which correspond most closely should be employed, while those tests which do not correspond at all should not be employed, regardless of any statement of the authors or any preconceived ideas of the reader as to what tests ought to foretell ability in any particular line of work. The proof of a test or of any method of prognostication lies in the degree to which it actually arranges people in the order of their relative efficiency in the tasks for which one seeks to foretell success.

A mere glance at a record such as that shown below for twenty-eight sixth-grade pupils would show that there was a real relationship between the scholarship marks, the teacher's estimate of intelligence, and the results of educational measurements taken by an outsider.

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SCORES AND RATINGS OF SIXTH GRADE CLASS

NAME OF PUPIL	EDUCATIONAL MEASUREMENTS SCORE (NO. OF ERRORS)	TEACHER'S RANKING OF INTELLIGENCE (1 IS BRIGHTEST)	SUMMARY OF TEACHER'S MARKS IN SCHOLARSHIP
Adelaide	36.	19	85
Ruth	16.5	15	90
Alexander	25.5	7	93
LaMonte	46.5	6	93
Earl	76.5	18	77
Joseph	20.5	20	85
Amadeo	75.	14	85
Leo	43.	5	93
William	53.5	9	92
Isabel	25.	21	76
Ida	36.5	4	94
Hasel	15.	10	90
Frederick	65.	26	86
Charles	58.5	13	85
Edward	30.	1	98
Benjamin	62.5	24	76
Bruce	56.	22	87
Alden	55.	12	87
George	60.5	17	87
Alice	29.	11	88
Almira	15.5	5	96
Helen	16.5	2	90
Elisabeth	65.5	23	75
Amelia	24.5	8	92
Edwin	19.	16	89
Robert	67.	28	71
Edna	47.	27	78
Samuel	72.	25	80

The things which are not so evident at a glance are the degrees of relationship between these three types of measures. Is the relation of educational measurements to the teacher's estimates greater than the relation of the measurements to the marks in scholarship given by the teacher? In order to measure precisely the relative degrees of correspondence between various measures and estimates of the abilities of individuals, it is quite evident that something more accurate and exact than mere inspection is necessary.

For an explanation of the method by which the exact relationship may be worked out mathematically between the results of a test and the true abilities of the individuals tested, the reader is

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referred to pages 326-331 in the appendix. The discussion which will be found there of the method of calculating a coefficient of coördination will not be difficult to understand nor will the method be difficult of application for any one who wishes to measure the exact reliability of any of the Mentimeter tests or of any other test. For many purposes such a record as is shown on the preceding page, giving the score of the individual in each test used, will reveal the essential facts regarding the correspondence between test results and demonstrated ability. The reader should be cautious, however, about accepting a conclusion drawn from casual observation of such a table as that shown on the preceding page without checking up the accuracy of this conclusion by actually working out the coefficient of coördination according to the method shown in the appendix.

When the reader has tried out, upon a fairly large group of persons of known ability, the Mentimeter tests which seem to him to promise greatest usefulness, and when he has made his calculations and discovered which tests actually do classify his people most accurately, it will then be possible for him to make an intelligent scientific selection of tests for practical use. Let us suppose, for example, that an employer wishes to have a set of tests whereby he may select intelligent sales-girls. By giving the ten or twelve tests which seem most hopeful for the purpose to fifty or sixty saleswomen, who have been in his employ long enough to demonstrate their relative degrees of ability and intelligence, the five or six tests may be chosen whose results show the closest relation to their demonstrated ability for intelligent salesmanship.

The results obtained by the separate tests chosen should also be compared, for two tests may measure practically the same mental trait and have a very high coördination with each other. In such a case, it would seem almost a useless waste to retain in the group two tests which measured the same phase of ability. The one of the pair which showed the less close relationship to the true ranking might be dropped from the list without much

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loss to the total effectiveness of the group of tests. A group of tests thus carefully selected would prove very helpful and effective in the selection of untrained material for training or in the classification of experienced employees according to their intellectual qualifications for the type of position held by the people on whom the validity of the tests had been proved.

The advantage of such a well-selected "team" of tests is not so much that it selects various grades of ability more accurately than supervisors could select it after many months of experience in trying to train the new material, but that the tests make a satisfactory classification immediately, which saves the salaries and time of those applicants who would certainly fail in the training period. Even with the very best coefficients of co-ordination between the tests and actual demonstrated ability in the trade or position, the tests will not be infallible. On the other hand, no supervisor's judgment would be infallible, either. And the supervisor would be much more likely to errors through personal likes and dislikes than the impersonal tests could possibly be.

The tests are an invaluable aid, when they are themselves chosen with the scientific care outlined above, although it would be a short-sighted policy for any firm to trust entirely to the results of intelligence tests in the employment of its personnel. Appearance, voice, education, manners, physical size, and many other qualities are sometimes quite as important as the degree of intelligence, and the intelligence tests do not measure other elements of personality than the mental qualities.

Warning should also be given against using a particular set of intelligence tests, selected because they show high correspondence with ability in salesmanship, for example, as a measure of the intellectual qualities of candidates for some other position. Sets of tests, selected because they have been found accurate in classifying soldiers or school children for instruction, may not be of maximum usefulness in classifying machinists or business

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managers. The Mentimeter tests offer a wide variety, from which it is proposed that only those shall be used which have actually proved useful in classifying candidates for the particular task concerned. There is no reason to believe that exactly the same type of intelligence is required in all positions.

Having chosen certain promising tests for experiment, having proved the validity of these tests by checking up the relation of their results to the true abilities of a group of old employees or persons whose relative capacities are known perfectly, and having selected those tests whose results relate most directly to intellectual ability and least directly to one another, one may begin to employ the tests thus selected for the sorting and classification of new recruits or applicants. The question which will at once confront the reader who is not experienced in the employment of statistics of this sort is "How shall the test results be recorded and interpreted?"

The answer to the question regarding test records is that the exact score of each person should be kept for each test to which that person is "exposed." One difficulty with the records kept of certain other group intelligence tests is that only the final total score is retained, while all the wealth of detail furnished by the different tests included in the series is lost. The total score on a series of six or eight intelligence tests is worth keeping, but the separate scores on each of the six or eight may prove to be even more illuminating than the total score. Two candidates may make the same total score on a series of tests but the one may make his points chiefly in memory tests with little help from the tests calling for complex thought, while the other may do very poorly in the memory work and very well in the thought tests. If only the total score on the series were retained, the usefulness of the series would be practically destroyed for many purposes.

For the interpretation of the result recorded on any test, one will need to use some short but intelligible scheme for stating the true relation of the score of any individual to the scores of

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the remainder of his group or to the scores of the other group of old employees used as a standard in selecting the tests to be regularly employed. It is not always safe to say merely that Mr. K—— is below the average of his group. As an extreme case of how unjust this might be, let us suppose that in one of the Mentimeter tests, A made a score of 0; B made a score of 2; C, a score of 1; D, 2; E, 3; F, 0; G, 10; H, 2; I, 3; J, 9; and K, 3. The average score of this small group, obtained by adding the eleven scores and dividing by 11, is 3.18. Mr. K—— therefore obtained a score which was below the average of the group, even though fewer than 20 per cent. of his group made better scores than he. *The average score is too much influenced by extremely low or extremely high scores.*

To arrive at a proper perspective for interpreting the score of any individual, it is necessary first of all to have a *distribution* of the scores made by all the persons in the group with which the individual is to be compared. Such a distribution should show how frequently each possible score was made. The table on the left illustrates the idea of a distribution, using as material the scores quoted above for eleven individuals tested by a Mentimeter test. This table shows that one person had a score of 10, that one other had a score of 9, and that 3 was the next highest score made. The mode, or most common score, in this distribution is a 2 or a 3, which fact makes K's score of 3 appear as quite typical of his group. The modal or most frequent score is a really useful score with which to compare the record of any individual, although it is not as safe a measure of the central tendency of a distribution as is the median score.

DISTRIBUTION

SIZE OF SCORE	FREQUENCY
10	1
9	1
8	0
7	0
6	0
5	0
4	0
3	3
2	3
1	1
0	2
TOTAL	11

The median score of a distribution is the middle score, than which there are just as many larger as smaller. The median score is found by beginning at one end of a distribution and

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counting through half of the frequencies. To count through half of the eleven frequencies in the above distribution would bring us into the midst of the three who had scores of 2, and therefore 2 is the median score with which K's score, or the score of any other individual, should be compared.

The reader who is mathematically inclined may wish to find the median point in the distribution, the point which bisects the distribution. To find this, one needs to study his facts carefully and make such assumptions as seem most probable for the facts which are not perfectly apparent. For example, of the three persons who scored 2 points, one individual may have had the third problem thought out and have been in the very act of writing the correct answer to it when the time was up, while another may have just finished problem two without having begun to read the third problem, and the third person may have been right in the middle of his thought about problem three. Not knowing what the exact truth is, we may assume that of the three who had a score of 2, one's true score was between 2 and 2.33, another's was between 2.33 and 2.66 and that the third's was between 2.67 and 3.00.

If we count out the five who scored 3 or higher, we shall still require half of the distance represented by the next highest individual in order to have counted out 5.5 (half of 11). If our assumption is true, then, we shall need to count half way down from 3.00 to 2.67 in order to find the median point, 2.83. The calculation of the median point is not necessary, however, unless there is a very large number of cases in the distribution and unless very accurate comparisons must be made. In passing it may be said that the calculation of the median point at 2.83 is just as sensible and just as accurate as the calculation of the average point at 3.18, and that the median point is a much more useful measure of the distribution than the more commonly used average.

The user of the Mentimeter tests will not, under ordinary circumstances, be satisfied with interpreting an individual's score

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merely by indicating its direction from the median, mode or average of a group. It will not usually be sufficient to say "He made the modal or most popular score," or "His score was lower than the average," or even "His score was higher than the median." Some indication will be desired as to how much better or poorer a given score is than the median, or just what percentage of the standard group made better scores. An illustration of the method to be employed in such calculations and a review of the method of finding the median is given below in connection with a distribution of scores on one of the Mentimeter tests. (See Mentimeter No. 24, page 234.)

I	II	III	IV
SIZE OF SCORE ANALOGIES TEST	FREQUENCY: NO. OF COLLEGE GRADUATES	TOTAL NO. FROM LOWEST SCORE	TOTAL % FROM LOWEST SCORE
30	2	129	100
29	4	127	98.5
28	10	123	95.3
27	22	113	87.6
26	32	91	70.6
25	20	59	45.8
24	18	39	30.3
23	8	21	16.3
22	4	13	10.1
21	2	9	7.0
20	1	7	5.4
19	2	6	4.7
18	1	4	3.1
17	1	3	2.3
16	...	...	.....
15	1	2	1.6
14	...	...	.....
13	...	...	.....
12	1	1	.8
11	...	...	.....
TOTAL.....	129		

Having distributed the scores obtained by a group of college graduates on the Analogies test, the next important step toward their interpretation is the totaling of the frequencies up to and including those of each possible size, as shown in the third column of the accompanying table. The fourth column is then prepared showing the corresponding *percentages* of the total

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number (129) of persons tested, for each of the total frequencies shown in column III. The table as a whole is then to be read from left to right. As an example, one may begin at 20 in the first column and read as follows: "1 college graduate made a score of exactly 20 points, making in all 7 individuals who obtained a score of 20 points or less, which (7) is 5.4 per cent. of the 129 individuals tested." Dropping the eye to the next percentage below this line in column IV, one can interpret the score of the individual who made a score of 20 as follows: "This is a poor showing for a college graduate, for of 129 college graduates tested only 4.7 per cent. made a lower score."

A very popular method of interpreting a score is to tell in what quarter or, as the statisticians would say, in what "quartile" of the distribution a given score is found. The upper or first quartile of a distribution is the range of scores below which 75 per cent. of those tested have fallen. The second quartile is the range of scores below which 50 per cent. are found but above which 25 per cent. of those tested are found. The third quartile is the range below which only 25 per cent. are found and above which 50 per cent. are found, and the fourth or lowest quartile is the range of scores in which are found the lowest 25 per cent. of the scores made. The first and second quartiles are above the median, while the third and fourth quartiles are below the median. Obviously the individual who scored 20 points in the Analogies test, and is included in the lowest 5.4 per cent. is also in the lowest quartile of the college graduate scores. The point dividing the first and second quartiles is called the 75 percentile, while the point dividing the third and fourth quartiles is called the 25 percentile. As was stated above, the median or 50 percentile divides the second and third quartiles.

Columns III and IV in the foregoing table assist one quite materially in calculating the median and the other percentile points. To find the median, one will need to count half way through the distribution, in this case to count out 64.5 scores ($\frac{129}{2} = 64.5$). The 20 persons who scored on 25, in the above distribution, are

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shown by column III to be included in the lowest 59 scores and by column IV to be in the lowest 45.8 per cent. To include 64.5 (or 50 per cent.) of the scores, 5.5 of the 32 individuals who scored on 26 will need to be taken (64.5—59=5.5); 5.5 is .17 of 32, so it will be necessary to take .17 of the distance (26.0 up to 27.0) represented by a score of 26. This places the 50 percentile or median point at 26.17, if we assume that the 32 individuals obtaining a score of 26 were evenly distributed in their exact values between 26.0 and 27.0, which is the safest assumption one can make about these scores.

The 25 percentile is found by counting out one fourth of the frequencies, beginning with the low-score end of the distribution. In the case of the college graduates' distribution on the Analogies test, the 25 percentile is 24.63. The 75 percentile, which is found by counting out three fourths of the frequencies from the low-score end or one fourth from the high-score end of the distribution, is 27.26 in the case of the analogies distribution shown above. The "middle 50 per cent." of the distribution, or the second and third quartiles, lie between 24.6 and 27.3 according to these calculations. One may therefore assert that the typical college graduate, meaning one who is within the two middle quartiles of the college graduate distribution, should be expected to make a score of 24, 25, 26, or 27 on the Analogies test in the Mentimeter series.

Occasionally intellectual measurements are reported by tenths, the first tenth being the tenth of the distribution having the highest scores, just as the first quartile is the quarter containing the highest scores. For practical purposes with the Mentimeter tests, however, it is recommended (1) that the score made on each test be recorded, (2) that the median score of the standard group, with which each individual's score is to be compared, be calculated, and (3) that the percentage of the standard group making lower scores than that individual's score be used as an interpretation. For these simple interpretations, a table, such as that shown on page 102 for college graduates in the

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Analogies tests, practically completes the necessary calculations,* except for the calculation of the median score. It will be fairly intelligible to describe Henry Smith's score as follows: "Smith has a score of 24 points as compared with the median score of 26.2 points for his group. Only 16.3 per cent. of the college graduates make a poorer score than Smith, but 69.7 per cent. make a better score."

Assuming now that the reader has a fairly clear idea of how to administer and record the results of the Mentimeter tests, the next question to be answered is: "What shall be done about these test records?" Measurement in any field does not change to any appreciable degree the material which has been measured. The surveyor, for example, who measures the area of a field makes very little impression upon the soil over which he passes. A physician who measures the weight of an infant does not thereby increase that weight or diminish it. In the same way the psychologist who applies a Mentimeter test to a filing clerk, does not by that act increase the efficiency of that clerk. Measurements, of themselves, are of no value. Something must be done about the result which is obtained or all of the expense in time and money is of no avail.

The real purpose of a measurement is to tell facts about a situation more exactly and with greater objectiveness than they could be told in a description. A child may seem, on first appearance, to be under weight, but in order to know definitely whether or not that is true it is necessary to measure his age in terms of years, months, and days, to measure his weight in terms of pounds and ounces, and to measure his height in terms of feet and inches. All of these measurements taken together, however, will not hinder the child's growth or make him develop

*For the purpose of assisting the reader in keeping and interpreting records of the Mentimeter tests, the authors have prepared a record booklet which may be used with the tests to excellent advantage. It will be found economical to use this booklet because of the guide lines, headings, and practical suggestions which it contains, reducing copying and memory work in the calculations to a minimum. It is recommended also that calculating tables or a slide rule be used to calculate the percentages called for in the final column of the distribution tables. Such aids are very desirable because of their contribution to the accuracy of results and to economy of time.

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more rapidly; they merely indicate what his present condition is, without reference to what it may have been in the past or what it may become in the future.

As a sample of the great benefit which may be obtained from knowing mental facts exactly, we may consider the traditions and present status of our public school systems. Education has in the past been pointed, from the very beginning in the kindergarten toward the high school and the college and ultimately the professional school in which lawyers, physicians, ministers, and teachers were to be prepared. The child who by nature was not inclined toward the consideration of abstract ideas and theories soon found that the schools were not well adapted to his interests.

The percentage of persons in our population who cannot successfully think and work with abstract symbols and verbal ideas is very much greater than most of us have been inclined to believe. We have stated or implied that any boy who would stay in school long enough might fit himself to become a United States Senator or possibly a great newspaper editor, or lawyer. Those pupils who found it impossible to assimilate the type of thing that was offered by the public schools have been eliminated and sent out into the industrial world to find materials which would correspond to their interests.

Educators have still further made the error of saying or implying that it was the inferior people who were thus forced out of school. The authors of the present book wish to assert their belief that the mind of a man whose interests lie in handling people and concrete objects is not at all inferior on that account to the mind of the man who handles ideas and abstract conceptions.

Measures of intelligence have in the past been chiefly those which would be favourable to the abstract thinker. The Alpha test, used in the Army, proved conclusively to those who studied the results most carefully, that fully half of our population can never succeed, even moderately, in the manipulation of

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abstract ideas. The large proportion of our boys and girls who come to school are absolutely doomed to be unsuccessful and to become discouraged in their attempts to progress in the courses which are commonly given, and yet the public supports these schools, and the administrators of these schools try to claim that they offer "equal opportunity to all." Actually the kind of opportunity offered can be used effectively by only a small percentage of the pupils. Unless the child has the ability to interpret symbols and juggle ideas he is declared to be inferior and is forced out to learn for himself how to earn a living and to secure his rights.

The Mentimeter tests and other measures of intellectual abilities provide the means whereby pupils may be classified, at the very beginning of their education, according to the degree to which the formal academic training will be assimilated. These tests make it possible to select those who do not think abstractly but who require concrete objects or persons as the material for their mental activity. Unless the public recognizes that it owes an appropriate education to these people just as surely as it does to the academic few, it will not be long until this great group, in which our present schools develop the habit of failure and discontent, will arise to overthrow the injustices which our past aristocratic organization of society has handed on to them.

It is not proposed that certain individuals be selected by the Mentimeter tests and trained psychologists and then condemned to training of a less respectable order than that which is now offered. What is proposed is that by the use of intelligence tests students in schools be classified and placed in classes where they can learn things which it is within their mental power and interests to grasp and which will be of practical value and of social significance in the development of good citizens; rather than to continue, as we have in the past, condemning this large majority of our population to failure in school and elimination from the benefits of public taxation for education.

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It is no disgrace for a blind man to be unable to paint beautiful pictures, nor is it considered a great social injustice for a man of ordinary size to be denied the opportunity of serving as a giant in a side show. It should not be considered by any one that being a good valet or mule driver or boot black or street cleaner is a less respectable calling for a man whose mind demands concrete objects for its exercise than the expounding of the gospel or explanation of legal technicalities is to the man whose mind is inclined toward abstract ideas and relationships. If we are to have an effective social organization each person must do the type of thing for which his brain and his physical body fit him, without feeling that he is thereby either inferior or superior to any other person. We must help one another, each supplying that service for which he is best fitted. To continue as we have in the past, encouraging every child to look for a "white-collar job" at the end of his educational career is to foster the monster of discontent and unrest which threatens to destroy the very foundations of modern society.

If the Mentimeter tests which follow can do no more than point out for employers and educators the limits to which those who are dependent upon them can go in the understanding and use of abstract ideas, they will thereby have contributed materially to the happiness and contentment of a weary world. Along with the results of the tests there must, however, be this feeling of responsibility for one another and the recognition of the need for "pulling together" for the common good, each man contributing that for which his inheritance has fitted him, else we shall continue to force men to learn failure and discontent in our schools and thereby destroy the social structure we have been so long in building.

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CHAPTER X

THE MENTIMETER TESTS

TESTS of the abilities of human beings may be classified upon a great many different bases. It is possible, first of all, to classify them according to the qualities of mind and body which they measure. The reason it is difficult so to classify tests of mental ability is that the mind refuses to be cut up into different parts, each one responsible for a specific characteristic. No test can be solved by the use of one and only one group of intellectual faculties. The results obtained in any mental examination are the complex effects of an immense number of different characteristics. No attempt has therefore been made in the classification of the Mentimeters to say that one measures imagination, another measures attention, and another some other quality. Almost every quality enters to some degree in each test.

It is possible to classify tests according to the subject matter which they contain. The Mentimeter tests are so arranged, where it is possible, as to cover a very wide range of subject matter.

It is possible to classify examinations according to the activity required of the candidate being examined. A number of the Mentimeter tests call for *completing* a series of objects or ideas, while a number of others call for *memory* of a certain sort, and still others require *discrimination* between certain differing elements. These differences in the activity of the candidate examined, are not, however, the chief distinctions to be made between the tests.

It is possible to classify measurements according to the number of candidates that may be examined at the same time.

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Some tests cannot be given readily to more than one person at a time, while other tests can be given to several at the same sitting. In so far as possible, the Mentimeter tests are so arranged that they can be given to large numbers at the same sitting. This makes for economy of time and of effort on the part of the examiner.

It is possible to classify tests according to physical characteristics of the candidate examined, such as tests for infants, tests for children, and tests for adults, or tests for the blind and tests for the deaf. The first test in the Mentimeter series is for infants while the remainder of the tests are intended to measure older people.

Tests may further be classified according to the language capacity of the candidates who are examined. Certain of the Mentimeter tests are for non-English-speaking persons primarily, while others are primarily for those who speak English, and still others for those who read English.

The Mentimeter series of examinations which follows consists of thirty different tests, the majority of which are modifications of tests which have been used previously elsewhere. The first test in the series is to be used as an individual test of very young children. The blank provided furnishes brief suggestions, at each point, of what the procedure should be, and also furnishes a place for the examiner to record the result of his questions and observations.

Each examination booklet in the Mentimeter series has on its title page blanks as follows:

NAME_____

AGE AT LAST BIRTHDAY _____ LOCATION_____

_____

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The space headed "Location" is to be used to indicate the business or industrial organization or the department of the candidate being examined; or the grade, class, and school of a school pupil. These blanks should always be filled out before the examination begins.

At the middle of the page directions are frequently given with examples to serve in explaining concretely just what the nature of the test is going to be. In the lower right-hand corner of the title page there appears a blank, preceded by the words "Total Score." This is to be filled out by the examiner after the candidate has marked his paper and after the examiner has scored the results.

Tests numbered from 2 to 10 are classified as tests for non-English-speaking persons. They were designed originally, and can best be used, as group tests, although the directions given on the following pages for these members of the Mentimeter family are usually in terms of an individual examination. If it had been possible to prepare and furnish with this book large charts on which the explanatory samples could be exhibited and the pantomime instructions clearly demonstrated for a group of people at the same time, the instructions would have been printed as for a group examination. Within the confines of a title page of a test booklet only small examples can be presented, and therefore the instructions are for measuring one individual at a time. Any employer, teacher, or supervisor who plans to make use of these tests for non-English-speaking persons would do well to prepare the demonstration material in enlarged form in order to use it in giving the tests to groups of individuals at the same time.

In giving a group test it is practically always necessary to obtain the identifying information called for on the title page before the booklets are opened or turned over. There is a distinct tendency for candidates to try to glance at the pages which follow unless specific directions are given as the papers are distributed that this must not occur.

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The procedure in giving Mentimeters 2 to 10 to people who can understand and even read English is very little different from the procedure to be used with the foreign language speaking groups.

Mentimeters 11 to 15 cannot be given as group tests because of the great amount of writing which this would entail. Group tests are most efficient when candidates are required to do nothing other than check the correct answers without having to write anything.

Mentimeters 16 to 30 may be given as individual examinations, although they are planned as group examinations and the results obtained from their use as group examinations will be superior to the results obtained from their use as individual examinations.

In giving all of these tests it is very important that the printed forms prepared by the publishers be employed and that the directions which follow be carefully observed. The stencils furnished with the printed test booklets make it possible for a clerk of average mental capacity to mark and score the results of these examinations with great rapidity and with just as much accuracy as could be obtained by specialists working without such stencils. These stencils and the group method make psychological examinations economical of administration.

The list of Mentimeter tests is as follows:

THE MENTIMETER TESTS

TEST FOR INFANTS

1. Typical Performance

TESTS FOR NON-ENGLISH-SPEAKING PERSONS

2. Pictorial Absurdities
3. Maze Threading
4. Dot Pattern Correction
5. Dividing Geometric Figures
6. Completion of Form Series

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7. Checking Identity of Numbers
8. Digit-Symbol Substitution
9. Completion of Number Relation Series
10. Addition Tests

INDIVIDUAL TESTS FOR ENGLISH-SPEAKING PERSONS

11. Memory for Numbers
12. Repeating Numbers Backward
13. Memory for Sentences
14. Speaking Vocabulary
15. Word Discrimination

GROUP TESTS FOR PERSONS WHO READ ENGLISH

16. Naming Opposites
17. Spelling Tests
18. Range of Information
19. Reading: Vocabulary
20. Reading: Directions
21. Reading: Interpretation
22. Disarranged Sentences
23. Completion of Sentences
24. Analogies or Mixed Relations
25. Handwriting Tests
26. English Composition
27. Poetic Discrimination
28. Arithmetic Reasoning
29. Practical Judgment
30. Logical Conclusions.

MENTIMETER No. 1

TYPICAL PERFORMANCES OF YOUNG CHILDREN

Character of the Test.

The mental capacity of adult persons is indicated rather accurately by the number and variety of things they have

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learned from the school of life, omitting from the count so far as possible those things directly taught by the formal schools. The intellectual capacity of an infant is likewise indicated roughly by the changes which his brief experience in life has brought about in his ability to control himself and his immediate surroundings. At birth the child is practically without control of his own body, except for certain sucking reflexes, certain crying reflexes, and the reflex which causes it to grasp with its fingers or toes the finger or pencil which is brought into contact with them. These reflexes can hardly be said to be a part of the child's control of his own body, for the child could not avoid obeying them if he so desired. The new-born infant is practically helpless even so far as his own body is concerned. Any degree of control he may later develop over his body or over other things outside is attained because he has a system of nerve and brain cells capable of forming connections and being modified by these connections and their results.

The degree to which the child's nervous system is organized and supplied with potential connections by inheritance is reflected very early in life by the quickness with which it learns to control itself and its immediate environment. The most ready method of testing this inherited capacity is therefore to determine at any particular age just how complex and adequate a system of control has been developed. The tests for measuring infants and young children consist, then, in those performances under specified standard conditions, which are typical for children at various ages.

The Mentimeter for young children is based directly upon the findings of Prof. Lewis M. Terman and his students in their investigations of children from three to twenty years of age. This investigation was so carefully devised and executed that to improve on the product, the Stanford Revision of the Binet tests, would be almost impossible. The tests for children three and four years of age presented in the following pages are therefore not claimed to be new or original with the present

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authors, who hereby express to Doctor Terman their admiration for his excellent contributions in the field of psychological measurements. The tests here suggested for children under three years of age are modifications of those suggested by Doctor Kuhlmann. All investigators in this field are, of course, indebted to the pioneers, the French psychologists, Binet and Simon.

The method of this test series consists in putting the child into a well-defined situation and observing how he acts. The situation may consist partly in words or other noises impressing themselves upon his ears, or it may consist largely in visual sensations, or even in sensations of physical well-being in his own body. Under a given situation a normal child of a given age or older will act in a certain standard way. The measurement then is in terms of the age for which a given child's reactions are typical.

The test can best be given by one who is fairly familiar with the infant to be tested, although interest in having the child make a good showing should never be allowed to change one's judgment of the facts as to the child's performance. Another danger of too great familiarity is that the examiner may, without intention to do so, drill the child upon those things which are later to be required in the test. In so far as the parent knows what performances are to be included in the tests there is real danger that the child will be "coached up" on these things, even at as early an age as six months.

List of Typical Performances.

THREE MONTHS (3 tests, credit 1 month each)

1. Control of eyes (Both eyes look in same direction. Follows with eyes the movement of bright objects).
2. Hearing (Reacts with sudden start or scream to loud noises, such as slamming of door, hand clapping. Turns eyes or head in direction of less startling noises, such as opening of door, footsteps).

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3. Muscular Control (Moves hand or toy directly to mouth without striking other parts of body and face. Grasps or curls fingers about rattle or pencil placed in hands).

SIX MONTHS (3 tests, credit 1 month each)

1. Muscular Control (Balances head without support. Sits ten minutes or more when supported).
2. Self Direction (Attempts to catch self when beginning to fall from sitting posture. Reaches out for toys and near-by objects. Attempts to pull self to sitting posture if given a hand to grasp).
3. Enjoyment (Plays longer and more persistently with one toy than with another. Laughs aloud when bounced on bed or when familiars indulge in strenuous exercise).

ONE YEAR (6 tests, credit 1 month each)

1. Imitation of Movements (Can learn in half dozen trials to "wave bye-bye," put hands above head, or hide face in hands).
2. Locomotion (Creeps toward desired objects, or stands beside a chair without other assistance).
3. Understanding (Looks at frequently observed objects when names are mentioned: dog, ball, mama, flowers).
4. Obedience (Understands and usually obeys simple commands: "Lie down! No, No! Spit it out!").
5. Speech (Repeats simple syllables: "go, go; da, da; ma, ma; bye-bye").
6. Calls attention (Shouts exclamations, looks or even points to objects of special interest: dogs, cats, train, carts, etc).

TWO YEARS (6 tests, credit 2 months each)

1. Speech (Names articles of food desired: milk, cracker, rice, etc).
2. Pictures (Points out familiar objects: boy, dog, cat, cow, man).

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3. Obedience (Put ball in basket. Close the door. Bring the ball).
4. Imitation (Imitates actions of other children at play).
5. Discernment (Removes wrapping from candy; opens sack to get cookies).
6. Self Direction (Walks directly to desired locations; rides "kiddie-kar" forward).

THREE YEARS (6 tests, credit 2 months each)

1. Parts of Body (Points to nose, eyes, mouth, hair).
2. Familiar Objects (Names key, penny, knife, watch, pencil).
3. Pictures (Enumerates objects in pictures: Dutch Home, Canoe, and Post Office).
4. Able to tell own sex.
5. Gives last name.
6. Repeats sentences of 6 or 7 syllables.

FOUR YEARS (6 tests, credit 2 months each)

1. Discriminates between circles, squares, and triangles.
2. Counts four pennies.
3. Copies a square.
4. Comprehension of described situation.
5. Repeats four numbers in order: 4739 2854 7261
6. Repeats sentences of 12 or 13 syllables.

Directions for Giving the Test.

A very large part of this test must be given informally. It will be necessary to spend considerable time with each child examined in order to make certain that the reactions observed are not merely random movements which are not typical. For the tests of children three years of age and above the reader should very carefully study the detailed directions given by Professor Terman in his book, "The Measurement of Intelligence," published by Houghton Mifflin Company, if scientific accuracy of results is necessary. The materials called for may be secured from

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C. H. Stoelting and Company, 3037 Carroll Ave., Chicago. The directions given below are intended to be elementary and to indicate what is typical of children at each age rather than to serve as a perfect guide for the most scientific examinations.

Three Months

At the age of three months an infant should be able to co-ordinate his eyes; that is, to direct both eyes in the same direction and to move them simultaneously. When bright objects are brought into his field of vision and moved slowly from one side to the other, he should be able to follow with his eyes. As a matter of fact, many infants have attained this degree of control within the first week of their lives, but lack of control to this extent at the end of three months is an indication that special medical attention should be sought.

For several days after birth the infant does not ordinarily hear any of the sounds or noises which occur in his vicinity. By the time he has become three months old, it should be apparent, from the sudden start or scream of the child when a door is slammed or someone in his neighbourhood suddenly claps his hands, that the child actually hears these noises. The average child at three months has become so familiar with life and its evidences that he will be able to turn his eyes in the direction of such noises as the opening of a door or the sound of footsteps near his bed.

The first evidences of the child's recognition of sounds or sights are very difficult to interpret because they consist almost entirely in awkward, random moving of the hands and feet. Gradually the child develops some control over these movements and by the age of three months should be able to move his hand, or a toy in his hand, directly to his mouth without striking other parts of his body or face in the process. The early tendency of the infant to curl his fingers about a pencil or rattle which is placed in contact with them seems almost to disappear during the first month, but by the age of three months the child is again

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able to grasp such objects sufficiently to hold them for periods ranging from thirty seconds upward.

Six Months

The control of his body has so improved by the time he has reached the age of six months that the average child can balance his head without support for several minutes. It is usually possible also for the child to sit in a chair or on the bed with the support of pillows and bed clothing for as much as ten minutes. Occasionally, of course, the child will be able to sit alone as early as six months, but it is not wise to encourage this practice. The lack of ability to sit when supported at the age of six months is not necessarily an indication of lack of intellectual power but may be due entirely to physical weakness.

Not only has the child at six months arrived at the stage where he can balance his head and sit quietly when supported, but he has usually begun to try to assist himself in various ways. Very frequently this attempt at self-help will be evidenced by pulling movements intended to bring him to a sitting posture when a hand is offered to him. There is no hesitation in the ordinary child at six months in his reaching out for toys or for a hand which is held toward him. Very frequently it will be observed that such a child puts out its hand to catch itself if it is beginning to fall from a sitting posture.

The child has usually begun to show signs of pleasure and displeasure long before he has reached six months. This phase of development may be indicated by his playing longer and more persistently with one toy than with any other. It may be shown by much more animated activity when certain familiar individuals are present than would be evidenced in the presence of others equally well known. Very frequently children at this age indulge in amused laughing aloud when bounced on the bed, or when some well-known individual indulges in strenuous exercises accompanied by vociferous exclamations while the baby is watching.

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One Year

By the time a child has become twelve months old it will be possible to teach it many little tricks and movements of a simple nature. The child seems to imitate almost spontaneously the actions which are often repeated by its parents or nurse. Six to twelve trials should be sufficient to teach the average infant of one year how to "wave bye-bye" when told to do so, or how to hold its hands above its head when asked "How big are you?" or to hide its face behind its hands or behind one of its covers when someone exclaims "Peek-a-boo."

Some children never learn to creep before learning to walk. As a matter of fact, it seems fairly certain that the child who creeps rapidly may thereby postpone learning to walk. At the age of one year a child should be able to stand beside a chair without other assistance than the support given by the chair, or it should be able to creep very rapidly toward its toys or any other desired objects. Frequently, of course, children have learned to walk fairly well by the time they have attained twelve months, but this is rather unusual and is not particularly an indication of the degree of mental capacity.

The child of one year understands many common words applying to frequently observed objects which have been repeatedly called to his attention. When asked "Where is the dog?— where is the ball?— where are the flowers?" and such questions the average infant will turn its head and look toward the object mentioned, sometimes pointing, although this is somewhat unusual.

Simple commands such as "Lie down! No-no! Spit it out!" and the like, can be understood and are usually obeyed by children of this age.

The speech of a child at this age is of course very simple, consisting of one syllable words, usually repeated. Such expressions as "ma-ma," "bye-bye," da-da," "go-go," may be expected in the average child. It is unusual for an infant to

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combine two such expressions into a crude sentence at this age.

The child at one year quite frequently has begun to attempt manipulation of his environment as well as of his own body. Very frequently this will be observed in shouts or exclamations accompanied by looking or even pointing to objects which his familiars have previously pointed out to him, such as dogs, cats, trains, carts, etc. These objects will ordinarily not be named by the child, although peculiar sounds fitting each one may frequently be distinguished. Another manifestation of this same attempt at altering his environment will be the crying in which the child will indulge when he desires to change his resting place or to have something to eat.

Two Years

By the time a child has become two years of age its speech has developed to such an extent that it will be able to name, although frequently not with clearness and distinct pronunciation, many of its toys and articles of food. "Milk," "rice," and "cookie," are examples of the most frequently named objects. Many children have by this age also progressed to the point where two or three or more words may be joined together to form a crude sentence. There are on record children who by two years of age were able to frame fairly good sentences and even to read from simple books, but such records are very unusual.

At this time the child should be able to distinguish pictures of familiar objects, such as dogs, cats, horses, men and boys. This will be manifest not only in the child's being able to name the objects to which other people point in the picture, but when asked, "Where is the dog?" the infant should be able to point to it if the picture is at all clear.

Simple commands should be thoroughly understood and the well-trained infant will be able to obey without much delay such directions as "Put the ball in the basket," "Close the door," "Bring me the doll," and "Show me the book."

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The average child at two years of age has become distinctly aware of other children as persons more nearly related to itself than are the adults with whom it is ordinarily associated. This reveals itself in imitation of the actions of other children, such as waving the arms when other children do so, hiding the face against the wall when other children are playing hide and seek, and stepping rhythmically when other children dance.

By the age of two years the average child can distinguish accurately between that which is food and that which is not fit for eating. The wrapping from candy or cookies or other well-liked food will be removed or torn away before an attempt is made to eat the food. Frequently this will result in great annoyance when the child opens sacks and packages to which he is not entitled.

The child at this age has usually learned to walk quite erectly without hesitation to any desired location. If the child is placed upon a "kiddie-kar" his first reaction is to run it backward, but by the age of two years he should be able to guide it well in going forward. Some attempts will be made at running and a great many attempts at climbing by the time the child has reached this age.

Three Years

At three years of age a child when asked to point out different parts of its body (nose, eyes, mouth, and hair) can do so without hesitation. Familiar objects, such as a key, a penny, a pocket-knife (closed), a watch, and a pencil (common wooden) will be named at once if held out to the child with the question, "What is this?"

The pictures used in the Stanford Revision of the Binet test may be shown to the child with the direction "Tell me what you see in this picture," or "Look at the picture and tell me everything you can see in it." In response to such questions the child should be able to enumerate different objects, such as the little girl, the window, the chair, and the woman in the picture

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of the Dutch Home; or the men, the basket, and the newspaper in the picture of the Post-office.

At this age the child has had enough experience to be able to repeat its last name and to know whether people call it a "girl" or a "boy." The question should be asked in the following fashion: "What is your name?" If the answer is in terms of the given name only, then the question should be amplified as follows: "Yes, but what is your other name? Walter what?" If the surname is still not given, a fictitious one may be framed and the question asked in some such fashion as follows: "Is your name Walter Smith?" If the child is still unable to reply then it is probable that he does not know the family name or is too frightened to give it. In finding whether the child knows his sex the formula for a boy should be: "Are you a little boy or a little girl?" For a girl the question should be: "Are you a little girl or a little boy?"

At the age of three years a child should be able to repeat sentences containing six or seven syllables. Those used by Terman are: (1) "I have a little dog." (2) "In summer the sun is hot." (3) "The dog runs after the cat." In leading up to these repetitions it is well to ask the child first to say single words, such as "school." "Can you say school?" "Now say, 'I go to school.'" Then ask the child to say "I have a little dog."

Four Years

By this time the child should be able to distinguish between circles, squares, triangles, and other geometric forms. Ten drawings of circles, squares, and triangles should be presented to the child and he should be able to find one or two others just like the one to which the examiner points.

The child should by this time be able to count pennies or buttons, at least up to four, without any error. The child should be able to handle a pencil well enough so that a square one inch each way could be copied fairly well. The child's

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memory has developed to such an extent that if four numbers are repeated to him at the rate of one per second he should be able to repeat them in correct order at once. Three trials should be allowed and at least one of the three should be right. By this time, also, a sentence of twelve or thirteen syllables should be remembered correctly. The sentences used by Terman are: (1) "When the train passes you will hear the whistle blow." (2) "We are going to have a good time in the country." (3) "The boy's name is John. He is a very good boy." The method of getting the child's attention and leading up to these longer sentences is the same as was described under Year Three.

The child's judgment has developed by this time through experience and precept to the point where an inquiry from the examiner as to "What must you do when you are sleepy?" will bring forth a response indicating that one should go to bed and sleep. The question of "What must you do when you are cold?" should bring forth some such reply as, "Put on a coat," "Build a fire," or "Stand next to the radiator." The question, "What must you do when you are hungry?" should bring forth such answers as "Buy some lunch," "Drink some milk," or "Eat something."

Directions for Scoring the Test.

The method of scoring is briefly indicated in the list of typical performances printed on pages 115–117. The three tests at age three months are each to be given one month credit. The three tests at six months are likewise to be given one month credit for each successful performance, as are the six tests at one year. The six tests at two years, the six at three years, and the six at four years, are in each case to be given a credit of two months each. The child who did everything in the entire test correctly would then have demonstrated the mental ability of the average child of four years or older. The child who completes all of the tests at three months and one of the tests at six

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months would then be rated as having mental ability typical of a four-months-old-child. If the child were to fail on only one of the tests at one year but to pass all those previous to one year, his mental age score would be eleven months, according to this system of assigning credits. It will frequently be found that a child does not pass all of the one-year tests before being able to do one or two of the two-year tests and so on. This should not make it more difficult to score the test, for each particular performance has its value indicated in the list which was given above.

It cannot be claimed that these tests, especially those below the three-year-old level, have been fully standardized. They are, however, very much better than the average parent or relative would be able to prepare for him or herself. The mental age score which will result from the use of these tests is not as reliable as will result from the use of the Stanford Revision of the Binet tests with older children, but its reliability is sufficient to point out cases of retardation in intelligence or of distinct brilliance of mind.

Three Months

Control of Eyes. Both of the eyes should look in the same direction and the child should be able to follow with its eyes the movements of bright objects in order to obtain credit in this test.

Hearing. It will not be necessary for the child to react with a start or scream to loud noises and also to react by turning the eyes in the direction of less startling noises in order to obtain credit for hearing. Either evidence, if clear, will be sufficient to warrant giving credit.

Muscular Control. The grasping of a pencil or rattle should not be taken as sufficient evidence of muscular control. The ability of the child, however, to move his hand directly to his mouth as described above will be in itself abundant evidence that the child merits a credit in this test.

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Six Months

Muscular Control. Either balancing the head or sitting with some support for as much as ten minutes should be accepted as worthy of credit.

Self-direction. The attempt to pull himself to a sitting posture should not be taken by itself as evidence of credit in this test. Only when it is accompanied by one of the other two evidences should it be credited.

Enjoyment. Any two of the evidences of pleasure or displeasure listed may be taken together as indication of credit being deserved.

One Year

Imitation of Movement. Any one of the movements described, which the child learns within a short time by imitation, should give credit in this test.

Locomotion. Either of the two methods of demonstration will be sufficient.

Understanding. At least three familiar objects should be used in this test with success before credit is allowed.

Obedience. At least two simple commands should be understood and obeyed before allowing credit.

Speech. Not less than three different syllables should be used before credit is allowed.

Calling Attention. No credit should be given at this point unless the child very evidently attempts to excite interest and attention in two or three different objects.

Two Years

Speech. Any four distinct articles mentioned by the child when it desires them should be sufficient evidence to give credit here.

Pictures. At least four different objects should be recognized and pointed out before credit is allowed.

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Obedience. Two simple commands of the type mentioned should be sufficient to bring credit at this point.

Imitation. Only after repeated evidences of imitation of other children should credit be given here.

Discernment. Repeated evidences should be required before credit is allowed for this test.

Self-direction. Any one of the evidences described is sufficient.

Three Years

Parts of the Body. Three out of four parts mentioned should be pointed out before allowing credit.

Familiar Objects. Three out of five of the objects mentioned must be named in order to obtain credit here.

Pictures. The child should name at least three objects in one of the three pictures in order to obtain credit.

Sex and Name. Accuracy is necessary here.

Repeating Syllables. One of the three sentences should be repeated absolutely without error.

Four Years

Forms. Out of ten trials, at least seven should be correct in order to obtain credit.

Counting. No error should be allowed.

Copying. Out of three attempts, at least one should be fairly regular and distinctly recognizable as a square.

Comprehension. Success must be attained in two of the three questions in order to receive credit.

Repeating Numbers. One out of three trials should be absolutely correct.

Repeating Syllables. One of the three trials should be without error or two of the three trials with not more than one slight error in each.

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The matter of nourishment and physical well-being may retard a child to such an extent that his intellectual development is delayed. Great care should, therefore, be taken not to interpret a low score on this test too seriously. It should also be noted that familiarity with the test is quite certain to cause parents to put forth special effort to instruct the child along the lines required by the test. The test itself is thereby invalidated. Only when no special instruction has been given at any point covered by the test can one be satisfied that he is obtaining a fair measure of the child's ability.

The test booklet supplied for this test is not for the use of the candidate being examined but for the examiner to use as a guide and record of the examination. One such booklet should be used for each individual examined, in order to be certain that no test is omitted or wrongly scored and in order to have a record for comparison with future tests of the same individual or of other individuals.

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MENTIMETER No. 2

PICTORIAL ABSURDITIES

Nature of the Test.

One of the most popular tests in the Army Beta series was the mutilated pictures test, in which the soldiers were to draw into each picture what had been omitted. One great difficulty with this test was the tendency of intelligent men to spend far too much time trying to draw artistically the missing parts. The present test is a modification of that test, so arranged that instead of the candidate being required to draw a missing part he is only asked to make a check mark at the point where there is something that does not fit the remainder of the picture.

The test booklet is arranged with two samples on the title page to show clearly what is to be done when the candidate opens his booklet. By having these samples painted on the wall or blackboard, it would be possible to give the test to large groups of persons at once, although the directions given below are for testing one individual only at a time. Although listed as a test for non-English-speaking persons, some oral direction should accompany the motions by which the test is to be given, and English-speaking persons may be examined by this test as readily as those who speak a foreign language.

The graduation of the pictures according to their approximate difficulty makes the score in this test a real measure of the degree of absurdity which an individual can detect. The pictures themselves were chosen from as wide a field as possible in order to avoid undue advantage to persons of one type of experience rather than another. Only intelligent persons of fairly wide general experience will be able to make a perfect score in the time allowed.

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Directions for Giving the Test.

The examiner and the candidate to be examined should be comfortably seated at a table with the examination booklet between them. If it is discovered that the candidate is left-handed, the examiner should sit on the left, although under ordinary circumstances the examiner should sit on the right. The blanks on the title page of the booklet should be filled out by the examiner from any records he may have of the name and age of the candidate (if persons who read and understand English are being examined, several may be tested at once and each may be asked to fill out the blanks for himself). For persons who do not understand the English language the words which are used in the following explanations will be more suggestive than informing. The chief part of the demonstration will be the motions through which the examiner goes, and therefore great care should be taken that these be as suggestive of what is wanted as the examiner can make them. To secure uniformity of procedure the routine outline below should be carefully followed.

The booklet should be opened by the examiner and the pictures exhibited for not more than twenty seconds to the candidate, the examiner pointing from one to another of the first half-dozen pictures. He should then close the book and call the attention of the candidate to the picture of the rabbit on the title page. He should point to the rabbit's ear and then point to the inappropriate ear and shake his head. This pointing to the two ears and shaking the head when pointing to the wrong type of ear may be repeated as many as three times in order to impress on the candidate that one of the ears is inappropriate. He should then take his pencil and make a check mark above the ear which is incorrect.

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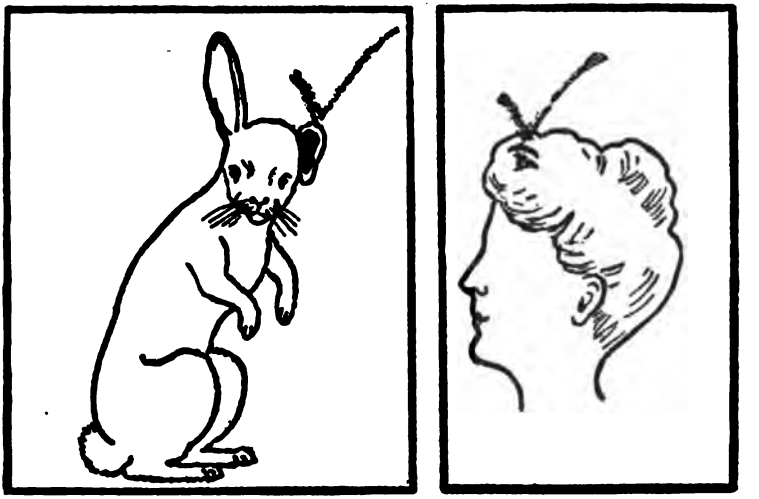
Mark (✓) the thing that is wrong



The examiner should then point to the second picture on the title page and look questioningly at the candidate. He may then point to the chin of the face represented and nod his head, "yes." He may next point to the nose and nod his head, "yes," but when he points to the place where the eye should be he should shake his head, "no," and pretend to look for the missing eye. When found, he should make a check a mark over the misplaced eye and smile at his achievement. If special emphasis seems necessary he may point again to the eye in its inappropriate position, and shake his head, repeating the check mark above it.

If the candidate understands but does not read English the examiner may trace with his finger while reading aloud the directions printed above the test pictures. "Mark (✓) the thing that is wrong." Exactly three minutes (180 seconds) should be allowed from the time the examiner opens the book and furnishes the candidate with a pencil.

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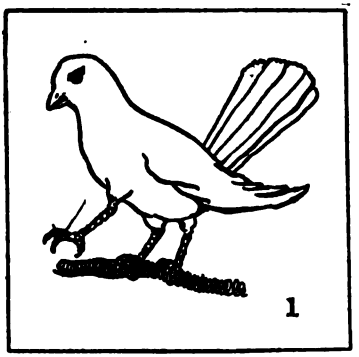
Mark (✓) the thing that is wrong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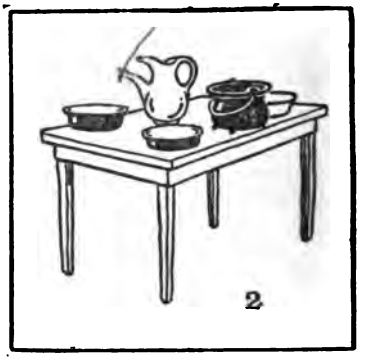
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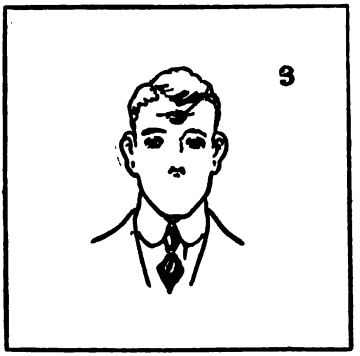
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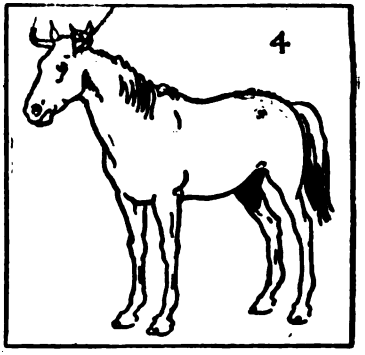
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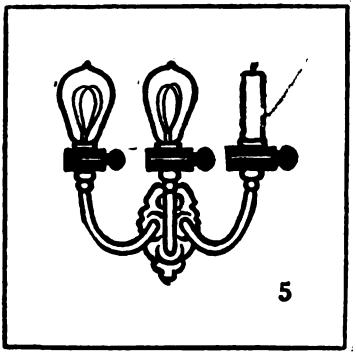
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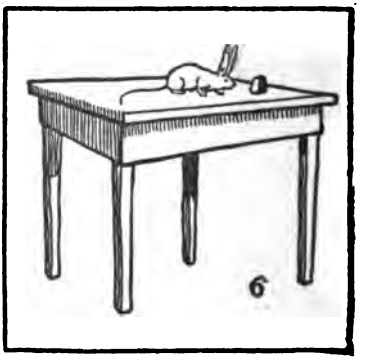
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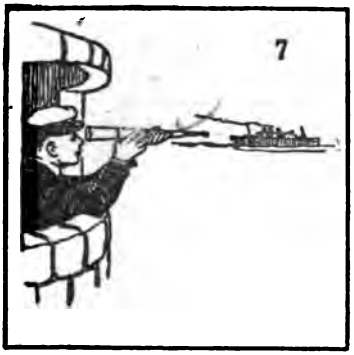
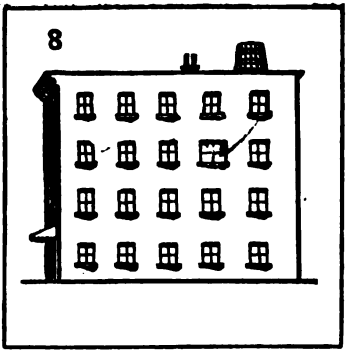
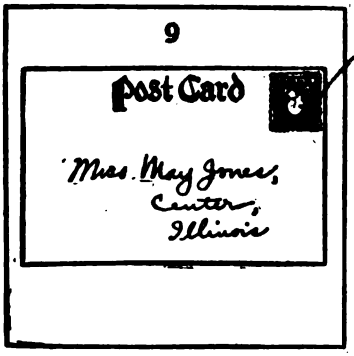
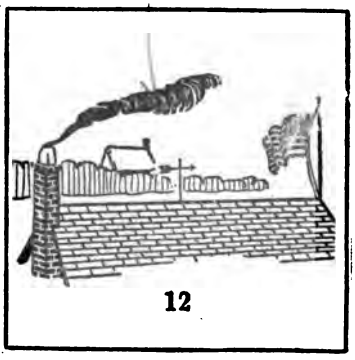
Mark (√) the thing that is wrong









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Mark (✓) the thing that is wrong

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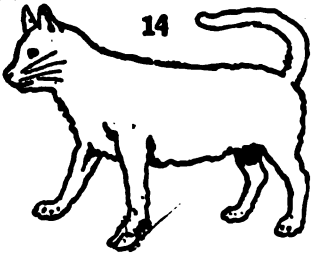

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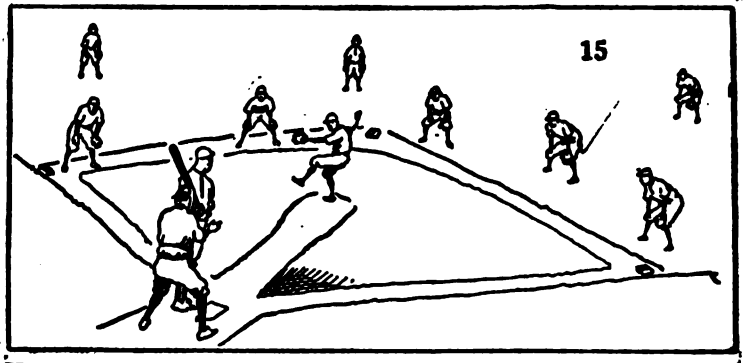

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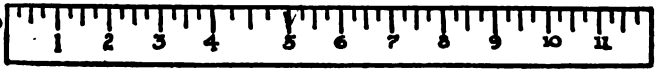

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Mark (✓) the thing that is wrong

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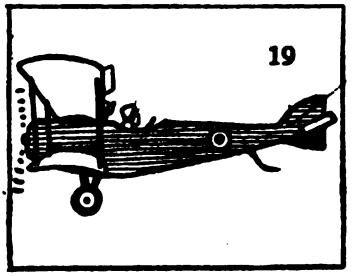

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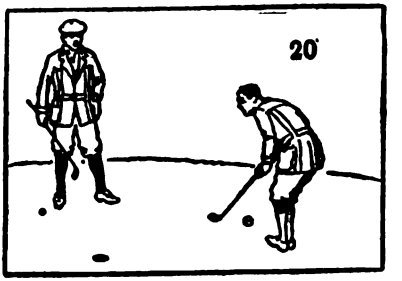

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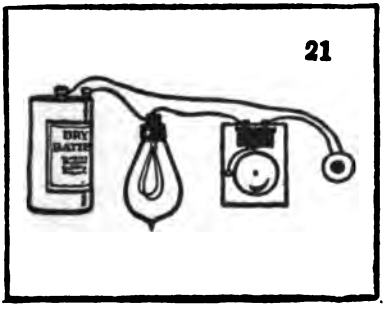

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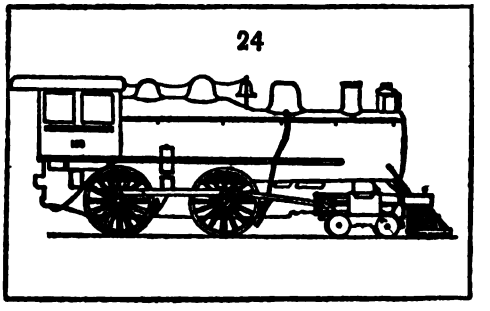

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At the end of the three minutes the paper should be removed and scored according to the following directions.

Direction for Scoring the Test.

The score in this test is the number of pictures in which the absurd element has been identified and checked. The stencil furnished with the test booklets shows exactly where each check mark should be made thereby saving some time for the person who marks the test. Where the proper element has been checked and the check mark later removed, no credit should be given. Credit should only be given where the final judgment as expressed by the check mark corresponds to the key furnished with the booklets.

A score from			0 to	6	indicates	Inferior Ability
"	"	"	7 "	10	"	Low Average Ability
"	"	"	11 "	17	"	Average Ability
"	"	"	18 "	20	"	High Average Ability
"	"	"	21 "	24	"	Superior Ability

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Mentimeter No. 3

MAZE THREADING

Nature of the Test.

A great many experiments have been made upon different types of animals to determine how long it would take them to learn to secure their food by going through an unusual "stunt" or travelling over a circuitous route. Mice have been taught, for example, to travel a long distance and through complicated mazes to secure their food, which is in such cases usually placed at the centre of the maze. The effectiveness of learning to thread a maze as a test of the intellectual capacity of the lower animals is probably not superior to the effectiveness of the same sort of learning as a measure of the intelligence of human beings. It is not possible, however, to include in a book the long passage-ways and blind alleys which would necessarily have to be built out of pretty substantial material in order to keep men from breaking over its sides, but the idea has so far as possible been carried out in the tests which follow. It is quite certain that the ability to trace through a printed maze with a pencil is not equal to the ability to walk through a specially constructed maze of steel, but it is as near the same problem as can be arranged on paper and printed in quantity.

The arrangement of mazes in this member of the Mentimeter family is such that the number of mazes successfully threaded is a distinct indication of the *complexity* of maze which the individual can successfully negotiate. The test is intended to measure the ability of any individual whether he can read or understand the English language or not. If the two examples shown on the title page are presented on a blackboard, or other large surface, the test may very easily be given as a group test by a skilful examiner, although the directions which follow are prepared for the examination of one individual at a time.

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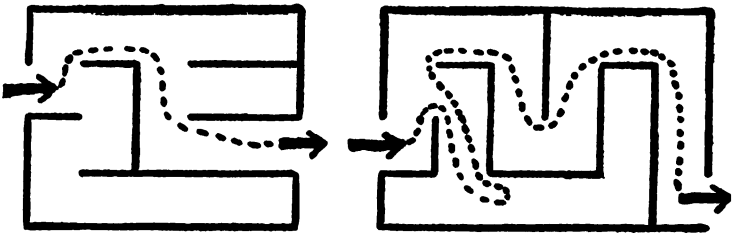
Directions for Giving the Test.

The examiner should be seated at a table at the right side of the candidate to be examined. He should first of all secure the information regarding the candidate's name, age, and other important items, and should then exhibit the mazes which appear inside the booklet, pointing from one to the other in the first half dozen. Not more than thirty seconds should be allowed for this part of the instruction. Turning back to the title page the examiner should point to the first example, pointing first at the entrance and then to the exit. By a motion at each of these two cardinal points, made in the direction in which the arrow points, he should make it clear that the idea is to move in the direction indicated by the arrows. He should then trace his way fairly slowly from the entrance to the exit.

Show by a line how you would pass through the drawings below without touching any line



Pointing to the second maze, first to the entrance and then to the exit, the examiner should again signify that motion is to occur at these two points. With his pencil as before he should trace his way from the starting point to the finish, making not more than one error, which he should correct by returning over the same route to the point where it was made without lifting the pencil from the paper.

If the candidate can understand the English language the examiner should then read the directions above the examples. "Show by a line how you would pass through the drawings below without touching any line."

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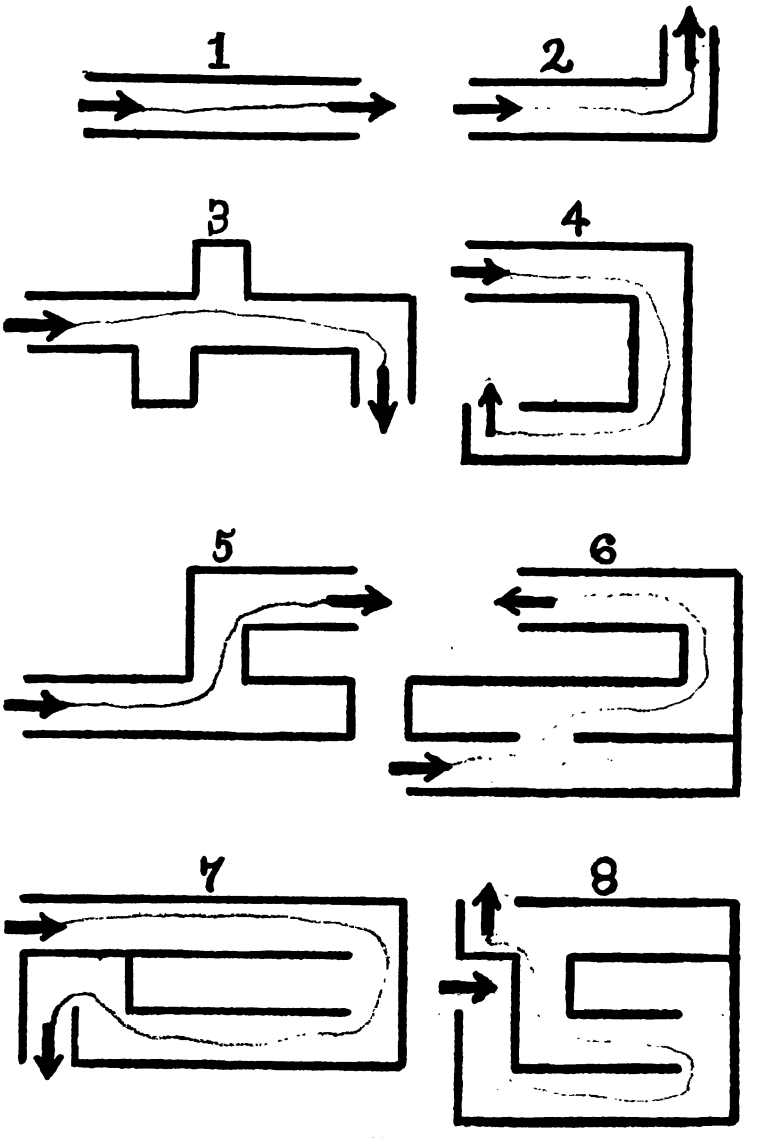
Show by a line how you would pass through the drawings below without touching any line



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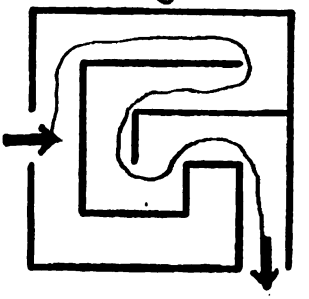
Show by a line how you would pass through the drawings below without touching any line

9



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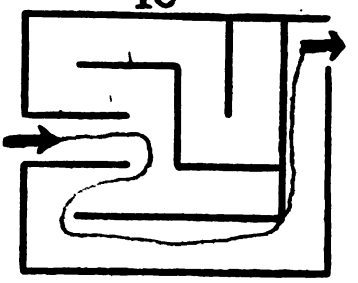

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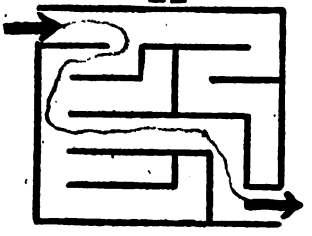

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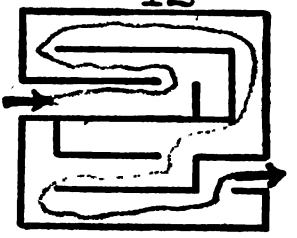

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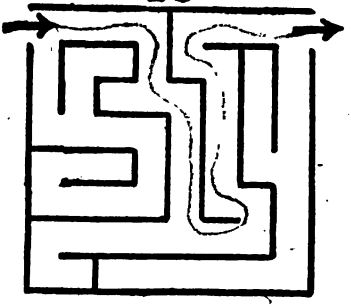

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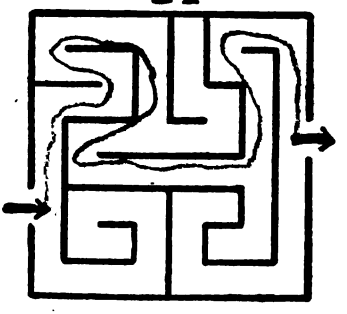

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The examiner should then open the booklet and give it to the candidate with the instruction to begin at number 1 and trace his way from the starting arrow to the finish. No demonstration should be made on the mazes which appear inside the booklet.

Exactly four minutes after starting the test the examiner should stop the candidate and remove the pencil.

Directions for Scoring the Test.

The total score in this test is the number of mazes correctly threaded without error. Where a line has been crossed through accident or unsteady holding of the pencil no penalty should be taken, but if a line has been crossed and not recrossed to correct the defect, no credit should be given for that particular maze. Full credit should be given for the maze as being complete if the line stops at a point somewhat before reaching the finish arrow, provided there is a straight path from the end of the line drawn to some part of this sign of the exit.

Scores from	0	to	5	indicate	Inferior Ability
"	6	"	10	"	Low Average Ability
"	11	"	16	"	Average Ability
"	17	"	18	"	High Average Ability
"	19	"	20	"	Superior Ability

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MENTIMETER NO. 4

DOT PATTERN CORRECTION

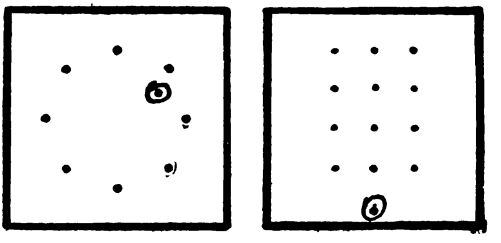
Nature of the Test.

The ability to recognize small elements of discord in an otherwise symmetrical pattern is the feature which this test is planned to measure. The test is very simple, even the most difficult elements in it being very easy of solution. A pattern composed of dots is presented, one dot being included which does not fit the remainder of the pattern. The candidate is required to locate this extra dot in each pattern and to draw a circle around it, indicating that it should be removed. Although an attempt has been made in this test to arrange the elements in the order of their difficulty, the last one in the series is so simple that almost any one can locate the defect in a short time. For this reason the test will not have wide usefulness except as a means of diversion. The method for this test is borrowed directly from the work of Doctor Pressey of Indiana University.

Directions for Giving the Test.

The directions herewith presented are intended to be used by the examiner in testing one foreign-speaking individual at a time. It would be easily possible to paint on the wall the examples given on the title page or to put them on a blackboard in such a manner as to enable the examiner to test quite a large number of persons at the same time.

Draw a ring around the extra dot



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The examiner should demonstrate to the candidate first of all the nature of the contents of the booklet and then should take up the two examples appearing on the front page. He should trace the direction of the different lines in the pattern with his pencil (without touching the point of the pencil to the paper) and should finally draw a small circle about the extra dot. After this circle has been drawn it would be suggestive to the candidate to trace out again the pattern of the example. When the candidate seems to get the idea, or when both examples have been demonstrated, he should be given a pencil and the opened blank with directions to go ahead. Only two minutes should be allowed for this work, at the end of which time the blanks should be taken from the candidate and scored according to the following directions.

Directions for Scoring the Test.

The score in this test is the total number of patterns in which the extra dot has been correctly pointed out. In many cases the extra dot is located in the centre of the pattern so that there is no really unsymmetrical element in the test, but this should not interfere with the scoring. The stencil provided with the test booklets makes it somewhat simpler to score than it would otherwise be.

Scores from 0 to 8 indicate Inferior Ability
" " 9 " 14 " Low Average Ability
" " 15 " 20 " Average Ability
" of 21 or more indicate High Average or Superior Ability

(SEE NEXT PAGES FOR THE TESTS.)

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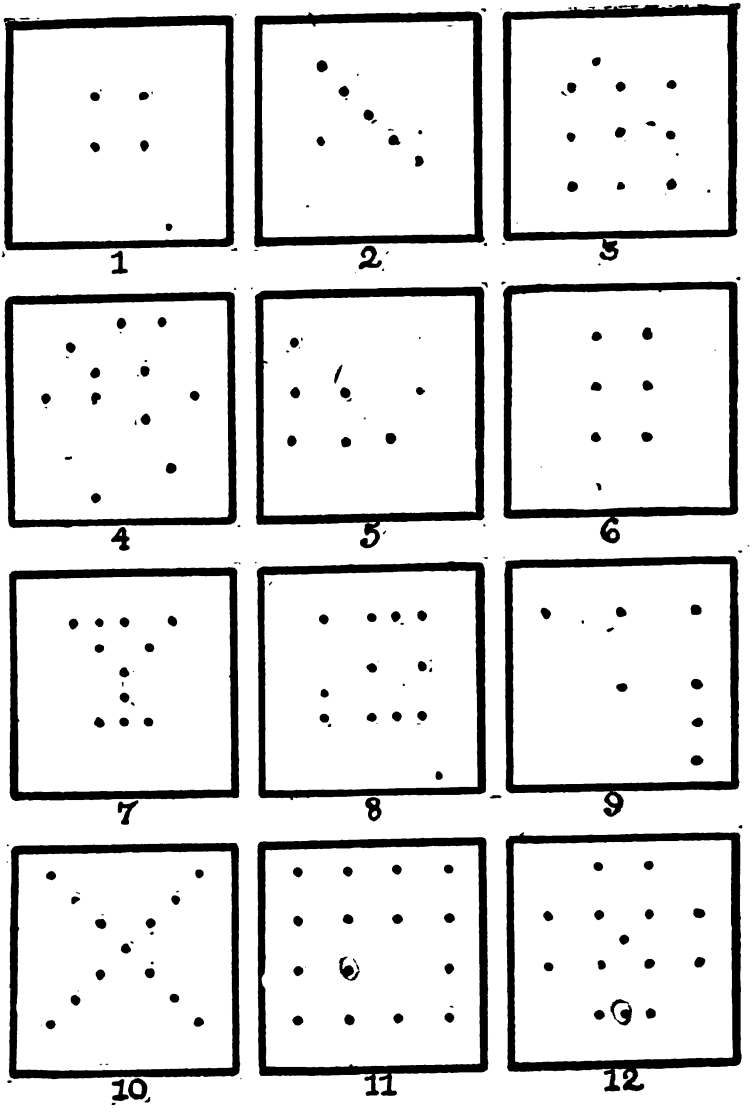
Draw a ring around the extra dot



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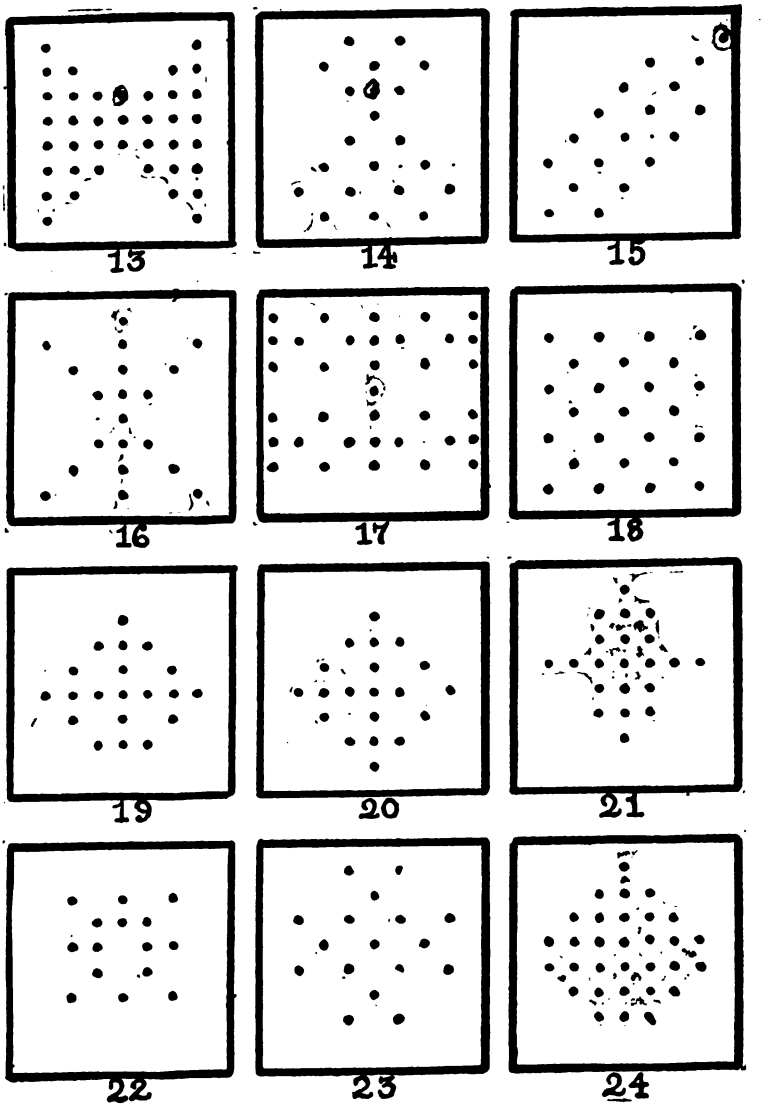
Draw a ring around the extra dot



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MENTIMETER NO. 5

DIVIDING GEOMETRICAL FIGURES

Character of the Test.

This test is very easily used as a group test with people who can understand spoken English. The test is also capable of being given to groups of illiterate or foreign-speaking individuals, if the examples used in the explanation are painted on a large blackboard to be placed in the front of the room in full view of all those taking the examination. In the absence of such a special blackboard, the test may be used as an individual test with illiterate or foreign-speaking persons.

Fifteen geometrical figures, such as squares, circles, triangles, and the like, are presented on three pages of the examination booklet. To the left of each figure are two or more small figures which, when properly arranged, form the large figure on the right. The problem of the candidate is to draw a line or several lines in the large figure on the right to indicate how it might be divided to make up the small pieces shown on the left. The first figures are quite simple and may be very readily done by drawing one or two lines. The problems on the third page require from three to five lines to be drawn and are distinctly more difficult than the problems appearing on the previous pages.

It is very difficult to say exactly what functions of the mind are measured by this test. The greatest difficulty with the test is that a rather high minimum of intelligence is required in order to understand what is necessary or desired. The two examples appearing on the title page of the test booklet are not sufficient to demonstrate clearly to the dull person just what he is to do. It is probable that dull people will succeed very much better in this test if it is given as a test for foreigners, using the special blackboard. The examiner could, in that case, draw a line with chalk to show what is expected. The printed

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directions on the test blank have been made as simple as possible, but they are not wholly satisfactory for the lower ranges of intelligence.

The scoring of this test is somewhat more difficult than for the majority of the other Mentimeter tests. It is intended that one point of credit shall be given for each large figure properly divided. The difficulty comes in being sure that the candidate has intended to draw his lines at exactly the proper place. Inaccuracy may be the result of not knowing where the lines should be placed, or it may be the result of careless execution. If a line is misplaced through careless execution, when it is perfectly clear that the right idea was present in the candidate's mind, full credit should be given for that element of the test. If it is not certain that the candidate understood where the line should be drawn, no credit should be given for that particular figure.

The stencils, which are supplied with each package of test booklets, should be placed to the left of the five geometrical figures and comparison should be made between the dotted lines of the stencil and the marks made by the candidate in the corresponding figure on the examination sheet. In the first square, for example, full credit should be given whether the line is drawn horizontally or vertically through the figure. The important thing is that two equal rectangles should be created by drawing a single line. Similarly, for each other figure, the important point to be considered is whether or not the lines drawn do form the geometrical figures shown on the left. A little practice will make it possible for the clerk who scores these tests to lay aside the key itself and to carry it in memory.

Various forms of this test have been used by psychologists for a number of years, although its most extensive use was in the Beta series of the United States Army. The same test in modified form was used by Prof. E. L. Thorndike in his tests of mental alertness in the air service. Many individuals were found who could do this test fairly well without being able to succeed with some of the others which were supposedly equally

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as good for general purposes. On the other hand, many individuals of good general ability were found who seemed lacking in the particular type of ability necessary properly to divide these geometrical figures. On the whole, however, the more intelligent men made higher scores than the less intelligent men. Such low relationship between this particular test and other tests of intelligence makes it particularly useful as one of a series to be used for measuring the intelligence of men entering certain mechanical trades where the recognition of the size and shape of objects is of prime importance. Draftsmen, architects, supply clerks, and candidates for similar positions would probably be rated more accurately by this test than would writers, musicians, and academic students.

In the public schools such a test might give some indication of the ability of children to succeed in mechanical or mathematical courses of study. In social gatherings, a great deal of amusement might be found by giving prizes to the individuals completing the entire fifteen figures correctly and in the shortest time. It would seem desirable, however, to omit the time limit when it is used for pure entertainment and to measure with a stop-watch the exact amount of time required for the individual. When all had finished the fifteen elements of the test, the papers could be checked up for accuracy and the prize could be given to the one who had finished correctly in the shortest length of time. This will add an element of interest for it is quite certain that some of those who finished first will have made errors, probably through careless execution, and that someone who finished later in the game will have drawn each line correctly.

Directions for Giving the Test.

a. As an individual test.

The individual to be tested should be seated at the left side of the examiner at a convenient table. The examiner should show the inside of the test blank to the candidate and should

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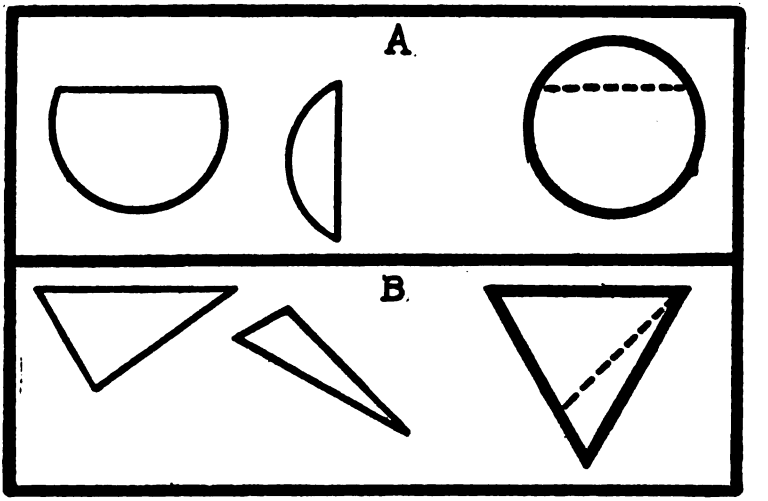
then point to the similar figures in the explanation on the title page of the booklet. He should then point to the large figure



in the first example, possibly tracing its outline with his pencil. Then the attention of the candidate should be called to the parts appearing on the left-hand side. (Their outlines may be traced if it seems desirable.) Next, a movement should be made with the hand as though one were placing the parts upon the larger figure. This may be repeated two or three times, pointing first to the various parts in order and then to the large figure with a rather broad sweep of the hand. After such a study of the situation, the examiner should draw the proper line and exhibit a smile of pleasure at having successfully done the thing. He should point then to the parts of the large figure which are thus created and by jumping his pencil from one of the parts to the corresponding part on the left, he may fairly clearly demonstrate that he has constructed, by his line, elements which are similar to the elements appearing at the left.

Similar pantomime may be used for the second example, pos-

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sibly introducing a variation by getting a line incorrectly drawn at the first trial, erasing it as soon as it is apparent that the parts do not correspond exactly with the parts appearing in the problem, and redrawing the line so that the correspondence will be exact. The pencil should then be handed to the candidate and the pamphlet opened up for him to begin work. The candidate should be allowed to work for four minutes with occasional signals to "Go ahead," "Work fast" or "Hurry up."

b. As a group test for illiterate candidates.

A blackboard containing the two examples should be placed in full view of all the candidates in the room. The test blanks should be passed to the candidates, with well-sharpened pencils or pens and ink. The examiner should then hold up in full view of the group a test blank showing the three pages of figures on which they are to work. He should then get the attention of everyone to the work by saying "Look" or "Watch." With a piece of chalk, he should then go through the pantomime described above for giving the examination to an individual. Care should be taken that none of the brighter candidates begins work before the signal for everyone to work. When the two examples have been thoroughly demonstrated on the blackboard, the examiner may turn to the group, open up his test blank, and point to the first page of work to be done and say, "Begin here," "Go ahead," "Work fast." At the end of four minutes, he should call "Stop," should collect all papers, making certain as he does so that some identification mark is present on the paper to show to which candidate it belongs. No special explanation should be given and no person in the group should be allowed to sit idle while the examination is going on. If it is clear that the individual has not understood, the examiner may say, "Do what I did," pointing to the board and then to the paper. Individuals may be told during the course of the examination, if they seem to be doing nothing, to "Make your marks."

c. As a group test for candidates who can read English.

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Place each candidate at a table or chair with a writing surface, supply him with a test blank and pencil or other writing instrument. While the candidates are being supplied, the examiner should make the following statement: "Do not open this booklet until you are told to do so. I shall make explanations as soon as everybody is supplied."

When all are ready, the examiner should hold up a copy of the test and speak as follows: "There are three pages of work to be done. The page before you shows two samples of the kind of thing you are to do. You will notice at the right a large figure and at the left several small figures. When properly placed together, these small figures will make one of the large figures at the right. You are to draw a line, or several lines, through the large figure at the right in such a way as to make of it the small figures at the left.

"Now look at the examples before you. Is there any one who does not see what line ought to be drawn in order to make the large figure show the pieces which appear at its left? You will have four minutes in which to do the work on the three pages. Work quickly, but be sure to draw your lines correctly. If you complete the fifteen figures before I call 'Stop,' look back over your work to see that you have made no mistakes."

If any candidate signifies that he does not understand, the examiner might draw an imaginary line with his hand to show the direction in which the line should be drawn in order to divide the figure properly. As soon as it is certain that everyone understands how to divide the sample figure, the examiner should say: "Now work rapidly and draw your lines on the next three pages." The time limit of four minutes should be followed exactly.

Directions for Scoring the Test.

The examination score, if each figure of the series is correctly divided, will be fifteen points. The stencils give but one solution to each problem although solutions are possible in prac-

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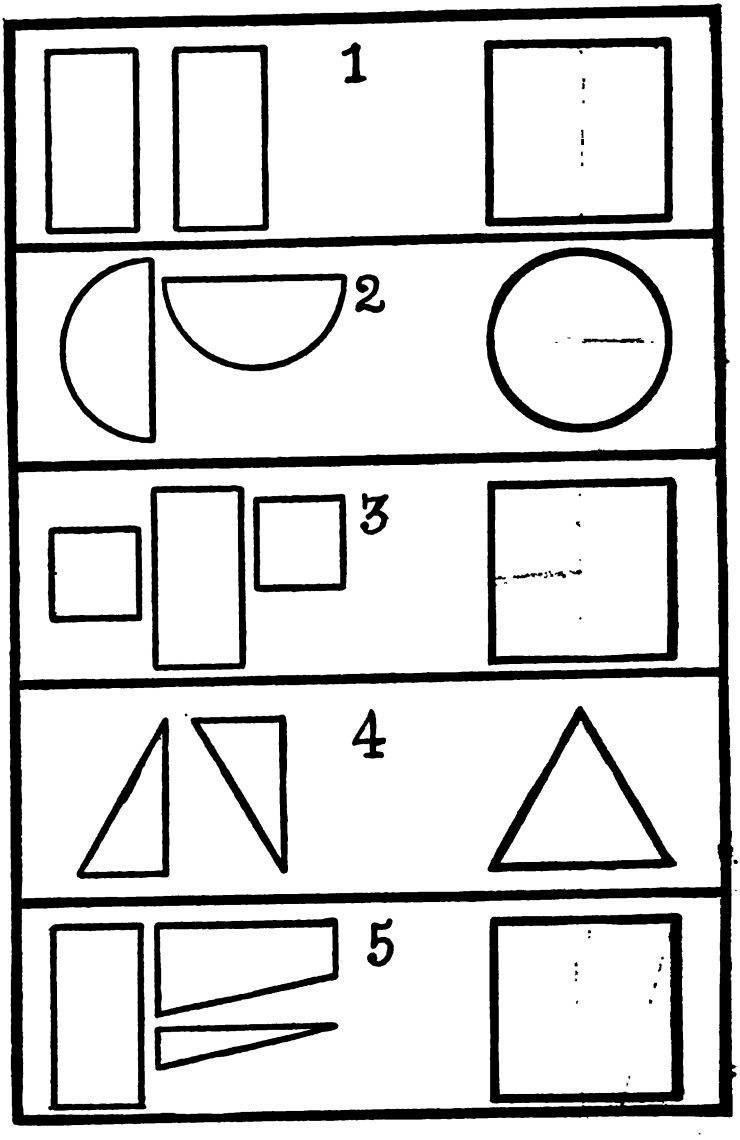
Make the small figures by drawing lines in the large one.



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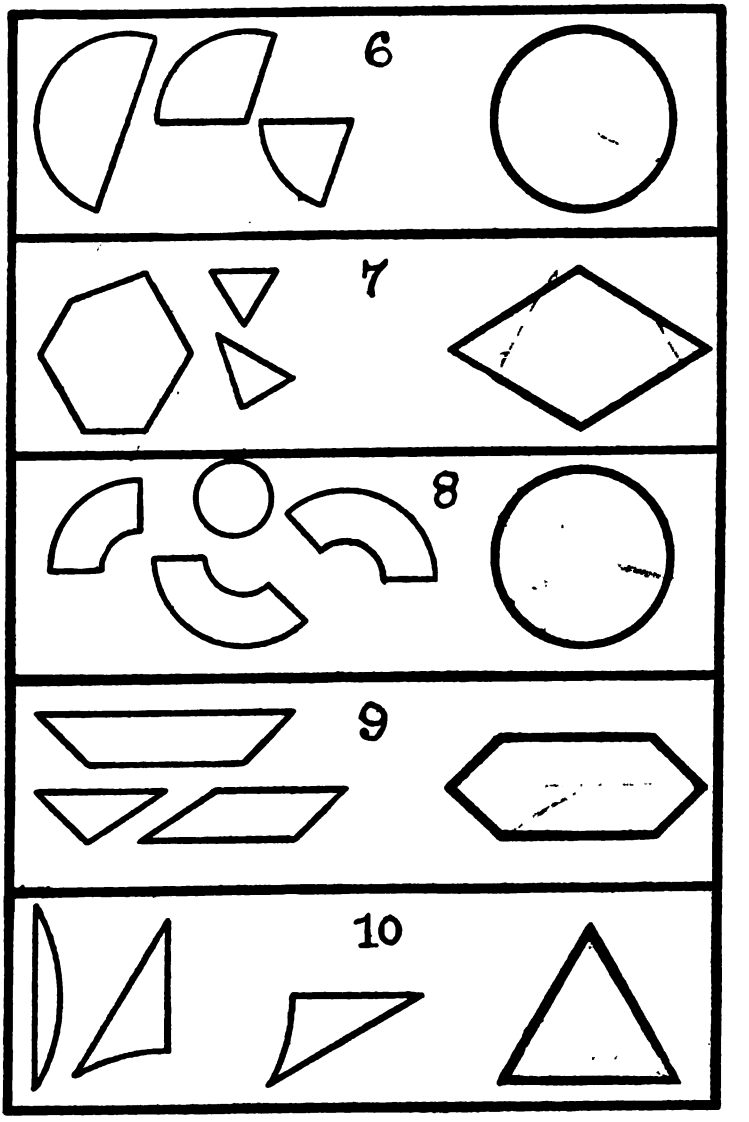
Make the small figures by drawing lines in the large one.



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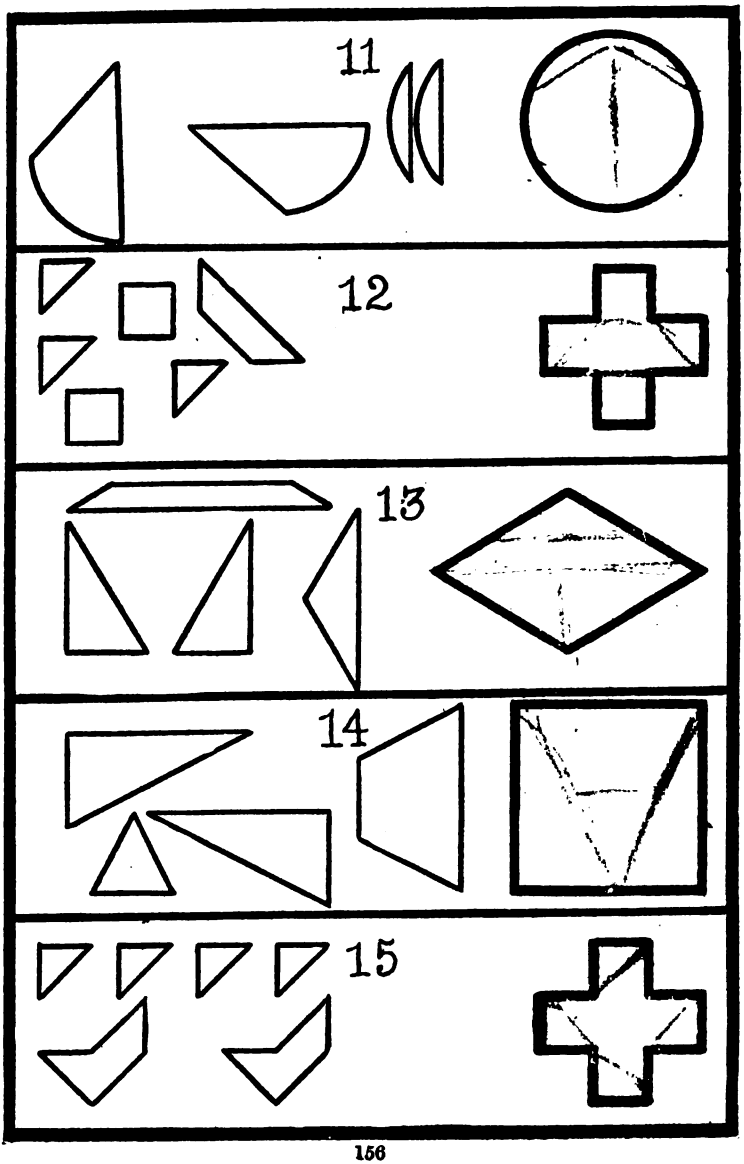
Make the small figures by drawing lines in the large ones.



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tically every case by drawing the same lines in a different direction. The angle or direction is unimportant and there is no need that the lines drawn by the candidate correspond exactly in this respect with the lines on the stencil. The important thing is to see that the proper lines are drawn to make the necessary parts. The final score obtained by counting the number of figures in which lines are properly drawn should be entered at the lower right-hand corner of the title page of the booklet.

Scores from	0	to	2	indicate	Inferior Ability
" "	3	"	5	"	Low Average Ability
" "	6	"	10	"	Average Ability
" "	11	"	13	"	High Average Ability
" "	14	"	15	"	Superior Ability

In interpreting these results, it should be recalled that inferior ability in this line of work may be found in individuals who have average ability in some other intellectual fields. This test should not be used extensively until it has been proven to have a high degree of relationship with the characteristics required in the group for which it is used as a selecting agency.

Mentimeter No. 6

COMPLETION OF FORM SERIES

Character of the Test.

The Completion test is always very satisfactory because it shows in itself just what should be done and does not require a great deal of special explanation. The Form-Series Completion test is particularly valuable in that it does not depend upon the English language either in its content or in the explanations to be made of it.

As with the majority of the other tests for non-English-speaking persons this test is here described as a test of one individual

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at a time, although it will be found very simple and easy to test a large group at the same time if the examples which appear on the title page of the test booklet can be painted on the wall or reproduced on a blackboard in such a way that the examiner can demonstrate to everyone at once just what is to be done. It is very desirable to examine large groups at the same time if the provision for such demonstration can be made.

Previous Form-Series Completion tests have required the candidate to fill in the last characters of each line, everything being printed in order up to within a few sections of the end. The present form, in which the elisions are distributed through the series rather than being grouped at the end, has the advantage that it may be made more difficult by far than the previous forms. Although this test probably measures a rather specialized type of intellectual ability, it is nevertheless sufficiently well graduated in difficulty so that the result obtained by it will show a close relationship to the result obtained in other more general tests.

The problem of the candidate who is given this test is chiefly that of solving, from the rather meagre data presented, just what the serial order of the different forms may be. This undoubtedly calls for a complex variety of special mental qualities, including imagination and abstract reasoning ability. Nevertheless, it is hardly possible for the authors to make any sort of estimate of just where this test will be most valuable or just what it measures. It will certainly be interesting and entertaining whether it works out to have any particular usefulness or not.

Directions for Giving the Test.

The candidate should be seated at the left of the examiner in order that he may conveniently work upon the test booklet which should be placed on a table between them. After filling out for the candidate the information blanks giving name, age, and the like, the examiner should show for fifteen or twenty

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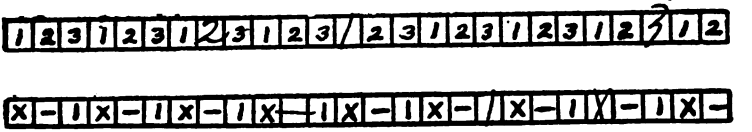
seconds (not more than 20 seconds) the inside of the booklet. He should then turn back to the title page and demonstrate the nature of the test by means of the examples printed there.



Probably the best and most effective method of demonstration is that of "jumping" the pencil rhythmically from one block to the next corresponding one to show the rhythmic sequence of the same symbols. When a block is reached in which the symbol has been omitted (but in which the samples have been crudely marked with a fine pen), the examiner should make an appropriate heavy mark such as is used in the printed sections of each series. After any symbol has been written on the explanation samples it would be very much worth while to skip rhythmically along the line making certain that the sequence is correctly followed. When it seems fairly certain that the candidate has grasped the rhythmic nature of the forms, the examiner should open the booklet, give him a pencil, and say "Put them in." "Fix it up." "Go ahead."

Allow exactly five minutes for this work. At the end of this time the examiner should take the paper and score it as directed below.

Directions for Scoring the Test.

The score in this test is determined by the number of lines in which the candidate has entered the correct forms to complete the line perfectly. No credit should be given if any one of the sections remain unfilled or be filled incorrectly. The stencil which is furnished with the test booklets makes the task of

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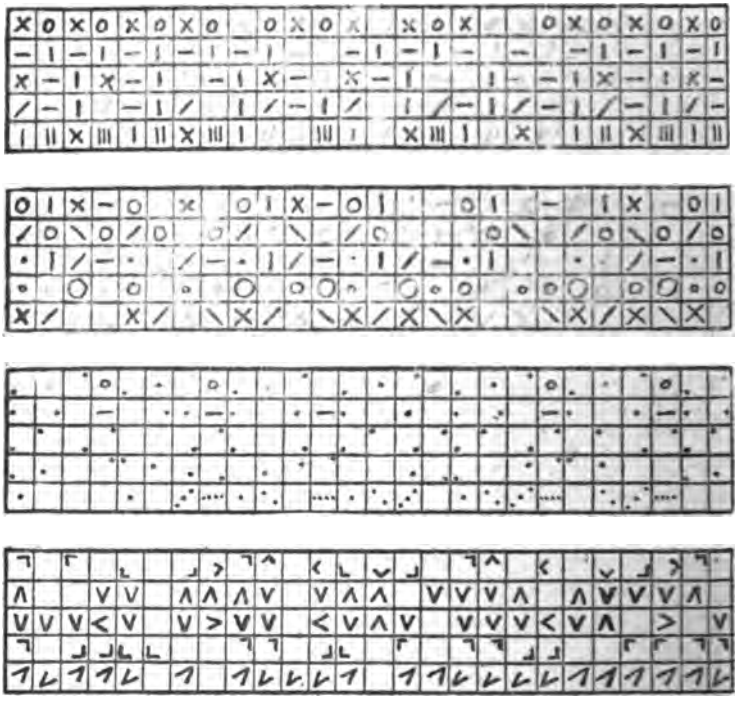
Fill in the missing forms



marking the errors very much simpler than it is without such aid. The total score obtained should be entered in the lower right-hand corner of the title page of the booklet.

Scores from	0	to	2	indicate	Inferior Ability
" "	3	"	5	"	Low Average Ability
" "	6	"	12	"	Average Ability
" "	13	"	15	"	High Average Ability
" "	16	"	20	"	Superior Ability

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MENTIMETER No. 7

CHECKING IDENTITY OF NUMBERS

Character of the Test.

Bank tellers and other clerical workers find it necessary very frequently to compare signatures or numerical figures as to identity. A test might be arranged in which it was necessary for an individual to compare several sets of numbers all of the same length and general appearance. Such a test would, however, resolve itself very largely into a test of speed. The present form attempts to eliminate some of the speed element and to take to itself as much as possible of the quality of measuring the complexity which is necessary to cause an error in the recognition of identity. There are thirty numbers to be compared with another list of thirty in a parallel column. The first numbers have only two digits but the number of digits is increased fairly regularly until in the last pairs eleven digits in one column must be compared with the eleven digits in another.

This test is probably as useful a measure of ability to notice small details as it is necessary to make. The chief objection to it will come from individuals who are not gifted by nature with the ability to think in terms of numbers. This objection is not serious and will not be as valid even in their own cases as those who make it are inclined to believe. The test may be given as a group test if some means be provided for demonstrating before the entire group at one time just what type of activity is wanted. The directions given below are for giving the test as an individual examination, but with slight modifications the same directions will serve quite well for group examination. It is not necessary, of course, for the candidates to understand the English language if the examiner is thoroughly effective in his pantomimic instructions.

Directions for Giving the Test.

As soon as the proper record has been made of the age, the name, and location of the individual being examined, the ex-

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aminer may turn the test leaflet and exhibit the two columns of numbers which appear on the other side. This exhibition should not be made formally and should last not more than twenty seconds. The pamphlet should then again be placed title page up in front of the candidate.

The examiner should then compare the identity of the numbers in the first example. The best way to do this would be to

1ST COLUMN	2ND COLUMN	SAME	DIFFERENCE	
356	356	☐	☐	A
738	758	☐	☐	B

point first at the 3 in the first column then at the corresponding 3 in the second column, nodding his head, "Yes." The same pointing from one column to the other should be done for 5 and for 6, the second column part of the pointing to be accompanied in each case by nodding the head, "Yes." As a summary of this first example, the examiner may place his hand over the entire three digits of the first column and then transfer it to the entire three digits of the second column and nod his head, "Yes," making merely a check mark (✓) on that horizontal line under the word, "same." With the second example the same sort of pantomime may be used until 5 in the second column has been compared with 3 in the first column, which should be accompanied by a shaking of the head and the verbal exclamation, "No, no!" The summary by means of placing the hand over 738 and then over 758, with another, "No, no," may be omitted if it is quite clear that the candidate has grasped the idea. In either case the examiner should make the check mark under the word "different." The sheet may then be turned and the pencil handed to the candidate with the direction "Go ahead. Mark them all." Exactly two minutes should be allowed after saying, "Go ahead." At the end of two minutes the paper should be taken by the examiner and scored according to the following directions.

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If the numbers in the second column correspond exactly with those on the same line in the first column, make a check mark in the square on that line under the word "Same." If the second set on any line differs in any way from the first, check that line under the word "Different."

1ST COLUMN	2ND COLUMN	SAME	DIFFERENT	LINE NO.
96	96	☐	☐	1
88	88	☐	☐	2
77	71	☐	☐	3
33	35	☐	☐	4
82	82	☐	☐	5
641	644	☐	☐	6
956	956	☐	☐	7
507	507	☐	☐	8
9572	9752	☐	☐	9
1832	1832	☐	☐	10
19560	19360	☐	☐	11
94083	94083	☐	☐	12
940817	940847	☐	☐	13
329506	326506	☐	☐	14
654938	654938	☐	☐	15
6998701	6997801	☐	☐	16
7105923	7105623	☐	☐	17
2501036	2500136	☐	☐	18
3674462	3674462	☐	☐	19
61558543	61585543	☐	☐	20
38910066	39810066	☐	☐	21
17198591	17198591	☐	☐	22
685342017	685342017	☐	☐	23
317762849	317762849	☐	☐	24
102435867	102435867	☐	☐	25
3484657120	3484657210	☐	☐	26
4686726631	4686726631	☐	☐	27
6571018034	6571018034	☐	☐	28
38797625147	38797652147	☐	☐	29
26557239164	26557239164	☐	☐	30

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Directions for Scoring the Test.

The score in this test is the total number of pairs the identity of which has been correctly checked, minus the total number of pairs in which an error has been made in checking the identity. For example, if the last line checked was the twenty-fifth line while two lines had been omitted and errors had been made in checking three other lines, then only twenty lines had been checked correctly, and three lines had been checked incorrectly; so the resulting score would be seventeen points. The maximum score obtainable is of course thirty points and will be obtained only in case every pair has been checked without error. It is possible with this method of scoring to obtain a score less than zero; for example, if a person had checked correctly ten of the identities and had made errors in checking fifteen others, the number of "rights" minus the number of "wrongs" would be minus five. In such cases the score to be entered on the lower right-hand corner of the candidate's title page is zero.

The stencil furnished with the test leaflets makes it possible to mark this test with great rapidity and without mental fatigue. The point at which care needs to be taken is in making certain that the total score, computed by subtracting the number wrong from the number right, is correct. For this reason the reader is advised to cross out the "line number" of any pair incorrectly checked and to draw a circle around the "line number" of any pair not attempted by the candidate. If this is done consecutively down the page, there will be little difficulty in calculating the total score.

Scores from	0 to 8	indicate	Inferior Ability	
" "	9 " 12	"	Low Average Ability	
" "	13 " 22	"	Average Ability	
" "	23 " 26	"	High Average Ability	26
" "	27 " 30	"	Superior Ability	

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MENTIMETER No. 8

DIGIT-SYMBOL SUBSTITUTION

Character of the Test.

Ability to master a language is usually very closely related to general intellectual ability along academic or abstract lines. The relationship between the age at which a child begins to talk and the length of time required later by the same child to learn to use a foreign language would probably be found fairly close.

The Digit-Symbol test has been used rather extensively and for many years as a form of measuring the ability of an individual to learn a new method of expressing himself. Many experimenters have used a Letter-Symbol test rather than the Digit-Symbol, but there seems to be little difference in the character of the results obtained.

The Mentimeter form of the test follows quite closely the corresponding test in the Beta series used in the Army. At the top of the page there appears a key showing just what symbol should be used to indicate each number or digit. The test itself consists of 100 digits with empty squares appearing below them in which one is to write, beneath each digit, its corresponding symbol as shown by the key on pages 166 and 167. An intelligent person usually begins with the first digit and supplies the proper symbol for it at each place it occurs in the test; then begins with the second digit and goes through the entire test writing the symbol for it, and so on. Those of average intelligence more frequently try to supply the proper symbol for each different digit in order as they appear in the test without going through the entire test with each symbol separately. The method of the candidate in doing the work should not, however, be allowed to influence the rating obtained on the test, except as one method may produce a higher score than another.

Investigations which have been made seem to show that although the symbols used are quite distinctly more difficult to

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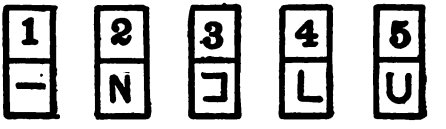
write than the digits themselves would be, it is nevertheless a better test to measure the number of symbols the candidate can write under the digits than to measure the number of digits one could write correctly under their corresponding symbols. The relationship between ability in this test and general ability to handle ideas and abstract notions is rather remarkably close. It is probable, however, that if the test were lengthened so as to require five or ten minutes rather than two and one half minutes the correspondence with intellectual ability would be increased.

This test will be very useful to employers seeking high-grade clerical service and probably in selecting administrative or supervisory officers. In the public schools it will be useful in some instances in classifying pupils for instruction. As a diversion in the home or social group it will have slight value.

Directions for Giving the Test.

This test has ordinarily been given as a test of several individuals at the same time. It is probable that it will not be as useful when given to one individual at a time as when used as a group test. The instructions are given here, however, as with the remainder of the tests for non-English-speaking persons, with the needs of examining foreigners individually uppermost in mind. By reproducing on the blackboard or on a wall chart the introductory examples one may adapt with almost no change

Key: This shows the mark for each number



Make under each number the mark which should be there

5	1	2	5	3	1	4	3	1	4	5	2	3	4	2
U	—	N	U											

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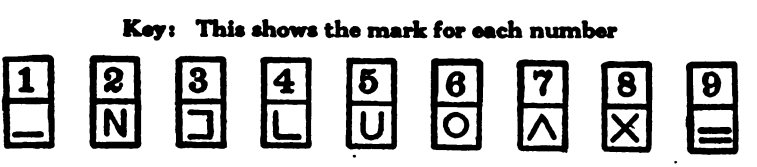
the method of administration here described so that it will work equally well with a group. It is advisable to prepare such in-



troductory charts and to give the tests as group tests rather than as individual tests, not only with the Digit-Symbol Substitution test but also with the other Mentimeters numbered from 2 to 10.

The individual to be tested should be shown the page on which

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he is to work, for not more than twenty seconds, and should then be shown the two examples appearing on the title page under the printed instructions, "Make under each number the mark which should be there." The examiner should then compare his key and the digits appearing in the sample series and should write in the proper spaces the appropriate symbols. The idea of getting the symbol from a key will be emphasized and made clear if the examiner at each point moves his finger or pencil from the digit in the example to the digit in the key, then to the symbol in the key and back to the empty space beneath the digit in the example. When all the spaces of the example have been filled (this should be done very slowly at first and then more rapidly toward the end of the example), the examiner should open the booklet, supply a pencil, and say, "Now! Go ahead! Put them in! Hurry up!"

Exactly two and one half minutes (150 seconds) should be allowed from the time the examiner says, "Go ahead," to the time he calls, "Stop!" All papers should be closed immediately and handed to the examiner.

Directions for Scoring the Test.

The score in this test is the number of symbols correctly supplied. Marking the errors is very much simplified by the use of the stencils furnished with each package of test booklets. The number of symbols correctly written should be recorded at the end of each line in the test and the total for all lines should be entered in the lower right-hand corner of the title page of the booklet.

Scores from	0	to	20	indicate	Inferior Ability
"	"	21	"	35	"	Low Average Ability
"	"	36	"	65	"	Average Ability
"	"	66	"	75	"	High Average Ability
"	"	76	"	100	"	Superior Ability

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MENTIMETER No. 9

COMPLETION OF NUMBER RELATION SERIES

Character of the Test.

This test may be given to any individuals or groups of persons who can read and understand the arabic numerals. The directions furnished herewith are for the measurement of a group rather than of an individual, although with very slight modifications in instructions the test leaflet may be employed in an individual psychological examination. The title page of the leaflet contains fairly complete directions and three samples of the number series to be completed. Persons who read English readily will have a distinct advantage over those who must depend upon oral instructions, but experience has shown that, even with individuals who do not understand the English language, it is possible to demonstrate on a blackboard, using the sample exercises, with sufficient clearness to enable foreign-language-speaking candidates to grasp the idea of the work to be done. No comparisons should be made, however, between results obtained by oral demonstration and results obtained through the use of the instructions printed below, without making allowances for the differences in method of administration.

The Number Relation Series test is so difficult to understand that it is hardly worth while to employ this test with children below ten years of age or with adults whose mental capacity is not equal to or better than that of the ten-year-old school child. The method of marking the test is quite simple when one is supplied with the stencil which is furnished with each package of test blanks. The present form of the test is somewhat different from those used elsewhere and it is difficult to say just what phases of intellectual or mathematical ability are measured by it. The Army intelligence tests included a number relation series test, so arranged that the last two numbers in each series

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must always be supplied by the person tested. Dr. Agnes Rogers, in her study of the prognostication of mathematical ability, employed a test which is very closely related to the one given here. Her results seem to show that this form of test is a splendid measure of mathematical capacity in high school pupils.

It is probable that this test will have very little usefulness in the selection of employees in general, but that it may be found valuable in discovering within an organization persons whose mathematical aptitude would make them very useful in positions where the handling of figures is an important part of the employee's duty. In schools the chief value of the test will probably be in assisting in the diagnosis of special mathematical ability or lack of ability among pupils entering high school. As a game for social amusement, it is not probable that this test will be highly popular, except among those who are mathematically inclined.

Directions for Giving the Test.

Having supplied each candidate with writing materials the examiner should announce as follows:

"I am going to distribute to you copies of a test which is intended to measure certain special mental capacities. I shall pass it to you with that side up which contains the directions. Do not turn it over or examine the 20 problems which are to be solved. Write your name where it says 'Name' and fill in the other blanks on the title page."

The blanks should be distributed, taking care that each candidate receives the blank right side up and that no candidate turns it over before the command is given to begin work. When names, ages, and other identifying pieces of information have been entered the examiner should ask the candidates to look at the directions carefully while he reads them aloud.

"The other side of this sheet has 20 series of figures, one or more of the figures from each series being left out. You are to

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look carefully at each series, to study out what kind of a series it is and then to write on the dotted lines those numbers which have been omitted. Look at the following samples.

Write on each blank the number omitted

2	4	6	8	10	..	14	16	18	20	Sample A
16	11	7	..	2	1	1	2	4	7	Sample B
2	..	..	2	2	3	2	4	2	5	Sample C

"In Sample A each number is obtained from the previous number by adding 2 to it; therefore, 12 should be the number between 10 and 14. In Sample B, each number is obtained from the next previous number by subtracting 1 less than was subtracted from the number before it—that is, 5 is subtracted from 16 to obtain 11, 4 is subtracted from 11 to obtain 7, 3 should then be subtracted from 7 to obtain a 4 which is to be entered on the blank. In Sample C, every other number is a 2 and therefore the second blank space should contain a 2. Between the 2's appear numbers, each one of which is one more than the one which preceded it. On the first blank in Sample C there should be a 1 in order to carry out this scheme."

"You will be allowed four minutes in which to complete the 16 series. Begin with the first and complete as many as you possibly can. Ready! Go!" At the end of four minutes after saying "Go" the examiner should call "Stop! Time up! Give me your papers." All papers should be collected at once.

Unusual care will need to be taken in giving this test to avoid variations in the directions used with the different groups examined. In order to maintain absolutely comparable test conditions, no variations from the language and routine given above should be allowed.

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Write on each blank the number omitted

1	2	3	4	5	..	7	8	9	10	Series 1.
10	12	..	16	18	..	22	24	26	28	Series 2.
12	11	10	..	8	7	..	..	4	3	Series 3.
1	3	..	7	9	11	13	15	17	..	Series 4.
..	39	37	35	33	31	29	..	25	23	Series 5.
4	5	7	..	14	19	25	32	40	..	Series 6.
$\frac{1}{64}$	$\frac{1}{32}$	$\frac{1}{16}$	.	$\frac{1}{4}$	$\frac{1}{2}$	..	2	..	8	Series 7.
8	15	..	29	36	43	..	57	64	71	Series 8.
10	..	15	16	20	21	..	26	30	31	Series 9.
2	..	8	10	..	10	20	10	26	..	Series 10.
7	..	10	11	13	14	..	..	..	20	Series 11.
..	4	9	16	25	..	..	64	81	100	Series 12.
..	4	7	14	17	..	..	..	77	154	Series 13.
32	..	..	..	28	29	26	27	..	25	Series 14.
6	10	13	..	..	..	15	13	10	..	Series 15.
60	55	..	..	46	45	..	46	48	..	Series 16.

Directions for Scoring the Test.

The score in this test is the number of series correctly completed regardless of the number of blanks in the series. The maximum score obtainable will therefore be 16 points. The stencil furnished with each set of test leaflets will make it very simple to count the number of series correctly completed. A convenient way of indicating that a series is not correctly completed is to cross out the serial number of that series. To indicate that the series was not attempted one might draw a circle around the serial number of that series. The final score should

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be entered on the title page of the leaflet in the lower right-hand corner.

Scores from	0	to	1	indicate	Inferior Ability
" "	2	"	4	"	Low Average Ability
" "	5	"	8	"	Average Ability
" "	9	"	11	"	High Average Ability
" "	12	"	16	"	Superior Ability

It should be borne in mind that the type of ability measured by the above scores is not necessarily a true indication of the general efficiency of the possessor.

MENTIMETER No. 10
ADDITION TESTS

Character of the Tests.

This Mentimeter is composed of two parts, one of them measuring the difficulty of the addition problems which a candidate can solve, and being therefore a fairly good test of intelligence, the other measuring the speed at which one can add fairly easy problems and therefore having less relations to intellectual ability.

Teachers in school furnish the children with certain information and knowledge or guide their pupils to the sources from which this information and knowledge may be obtained. In Addition, this information takes the form of "2 and 2 make 4," "9 and 5 make 14" and such sums. The instruction also involves such things as how to carry in addition, how to add when a decimal point enters into the calculation, and all such problems. The teacher also undertakes a somewhat different task, which is the review and drilling of the pupils in order to make the combinations which have been explained automatic in the minds of the children. It is not sufficient for John to know that "3 and 5 are 8," but he must be able to write or say

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"8" without any hesitation whatever when 3 and 5 are to be added.

In order to test the extent to which teachers have explained addition, one would measure the pupils with a test which increased in difficulty from the first problems to the last, undertaking to determine how difficult a problem can be solved. In order to test the rapidity with which the pupils have learned in their drill exercises to make the different combinations, one would measure the speed with which they can make the simple combinations. The first addition test which is given on page 175 measures the extent of the information which the candidate has gained, while the second measures the speed which the candidate has developed by drilling upon addition problems.

Teachers in the public schools will undoubtedly wish to measure both the speed with which their pupils do simple problems as a result of drill, and the difficulty of the problems which the child can solve correctly as a result of instruction. Of course the test for difficulty of problems solved is not absolutely independent of the effect of drill, although it is relatively much less dependent upon drill than is the other test.

In industrial organizations the first test given will probably be found most useful, while in social groups the greatest amount of entertainment will probably be obtained from the second test. The reliability of the results from the first test is very much higher than the reliability of the results from the second test, for in the second case a difference of one second in time allowed may make as much as one or two points difference in the score obtained.

As with all of the other tests listed in this series of "Tests for Non-English Speaking Persons," the Addition tests will bring more satisfactory results, with much greater economy of time, if they are administered as group tests. They are here described, however, as tests for individual candidates in order that they may be given to foreign-language-speaking candidates without any other apparatus than that furnished by the test booklets

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themselves. Any teacher or employer who has a number of persons to be examined should prepare a blackboard or wall chart on which to exhibit an enlarged copy of the examples used in the introduction. By placing this at the front of the room in full view of all candidates, the pantomimic instructions here described may be used for non-English-speaking candidates, or simple verbal explanations may supplement them for English-speaking persons.

Directions for Giving Mentimeter 10a.

The examiner, after securing from the candidate his name, address, age, and other pertinent information, should turn the examination leaflet and exhibit, for ten or fifteen seconds, the addition tests which are to be solved. The leaflet should then be turned over to the title page again and attention should be called to the examples appearing on the middle of this page under the heading "Add." The examiner should point to the first example $\begin{array}{r} 2 \\ \underline{2} \end{array}$ and placing his pencil on the lower 2 and then upon the upper 2 should seem to hesitate for an instant and then write 4 underneath the line. Looking at the second example $\begin{array}{r} 15 \\ \underline{3} \end{array}$ he should place his pencil on the 3 and then on the 5 and, with only an instant's hesitation, should write 18. Similarly, looking at the third example, $\begin{array}{r} 23 \\ 25 \\ \underline{16} \end{array}$ he should place his pencil first on the 6, then on the 5, then on the 3, and write a 4 underneath the line; then place his pencil on the 1 and then upon the two 2's in order and write 6 at the left of the 4. With this explanation the examination booklet should be opened and a pencil supplied to the candidate with the instructions "Go ahead! Add them all!"

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MENTIMETER No. 10a.

Add:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3	2	14	45	13	23	14
2	5	3	34	21	35	45
—	1	—	—	22	30	83
	—			—	—	—

(8)	(9)	(10)	(11)	(12)
34	197	374	796	7065375
67	225	49	867	8688256
95	659	623	745	2315553
52	316	5	933	1947272
—	—	548	542	3583419
		65	213	5224362
		—	564	6869021
			235	8518488
			676	3493625
			—	2657176
				—

Four minutes' time should be allowed for this test. At the end of the four minutes the examiner should call "Time up" and take the paper.

Directions for Scoring Mentimeter 10a.

The score in this test is the number of problems correctly solved. No credit should be given for any problem unless each digit in the answer is present, correct, and in its right place.

Scores from 0 to 5 indicate Inferior Ability
" " 6 " 8 " Low Average Ability
" " 9 " 11 " Average Ability
A score of 12 indicates High Average or Superior Ability.

Directions for Giving Mentimeter 10b.

The examiner should open the booklet and demonstrate to the candidate, for ten seconds, with just what nature of test he

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is to be confronted. Then, after securing the necessary identifying information, the examiner should point to the problems on the title page under the word "Add." Pointing to the 1 in the first example and then to the 2, he should write 3 under the line. Pointing to the 4 and then to the 5, in the second example, he should write 9 under the line. Pointing to the 4 and then to the 7 in the third example he should write 11 under the line, and should then pass his pencil and the opened booklet to the candidate with the instruction, "Go ahead! Add them up!"

The most important point in this test is to make absolutely certain that exactly thirty seconds (no more and no less) is allowed from the time the examiner supplies the candidate with a pencil until the time he calls "Stop!" Unless this time is kept absolutely uniform the results of the test will be hardly worth considering. Whether the candidate begins work or not, the time should be calculated from the instant he receives his pencil and the opened booklet.

Directions for Scoring Mentimeter 10b.

The score in this test is the number of correct answers obtained in thirty seconds. Unless an answer is absolutely correct, it should have no credit. If an answer is only partially finished when time is called, it should not be credited as being the correct answer unless it is sufficiently complete in both digits to prove that the right answer had been obtained.

Scores from	0	to	9	indicate	Inferior Ability
" "	10	"	21	"	Low Average Ability
" "	22	"	32	"	Average Ability
" "	33	"	44	"	High Average Ability
" "	45	"	60	"	Superior Ability

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MENTIMETER No. 10b

Add:

(1)	(2)	(3)	(4)	(5)
2	8	5	7	1
4	9	1	4	5
(6)	(7)	(8)	(9)	(10)
8	3	4	6	2
3	0	5	9	8
(11)	(12)	(13)	(14)	(15)
6	4	4	0	1
7	3	6	7	2
(16)	(17)	(18)	(19)	(20)
3	7	2	9	6
2	9	2	3	5
(21)	(22)	(23)	(24)	(25)
7	5	7	9	6
6	2	1	4	8
(26)	(27)	(28)	(29)	(30)
3	7	6	4	5
3	4	2	8	8

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MENTIMETER No. 10b (*continued*)

(31)	(32)	(33)	(34)	(35)
9	9	0	7	5
6	9	5	6	8
(36)	(37)	(38)	(39)	(40)
6	3	8	9	7
8	7	7	6	5
(41)	(42)	(43)	(44)	(45)
8	5	5	7	8
3	9	6	4	8
(46)	(47)	(48)	(49)	(50)
6	7	9	2	7
5	8	3	7	7
(51)	(52)	(53)	(54)	(55)
3	2	0	8	4
1	7	5	9	7
(56)	(57)	(58)	(59)	(60)
1	2	8	7	7
6	5	1	6	5

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Differences between Mentimeters 10a and 10b.

In connection with these tests of ability in addition, a few additional words should be said to make somewhat clearer the differences between educational tests and tests of intelligence. There is, of course, no sharp line to be drawn between these two types of tests. Mentimeter No. 10b may be classified very certainly as an educational test because it involves primarily the element of speed in simple additions which is not an accurate index of intellectual capacity but depends almost altogether upon specific drill. Improvement in ability to make a score in Mentimeter No. 10a will come much more slowly than in the case of the speed test in addition. Before a child can make progress sufficient to carry him from problem 5 to problem 6 in Mentimeter 10a, he must be instructed in the mysteries of adding zero to the sum of two other numbers. Before he can make progress from problem 6 to problem 7 he must learn to put down the 2 under the right-hand column of figures and carry the 1 to the next column and add it with the digits printed there. Each additional problem that he solves involves some new elements of arithmetic knowledge which can be learned only by careful study and one at a time.

In the speed test a larger score does not indicate ability to do anything more difficult or to understand anything more complicated, but merely more rapid doing of the things which are already fully understood. In the other test, however, a larger score indicates greater comprehension of more difficult situations and therefore an intellectual capacity which is of greater magnitude.

The primary purpose of the Mentimeter tests is to measure intellectual capacity rather than school training. For this reason very few tests which may be classified as primarily educational have been included. Where they have been inserted, they have been arranged to measure the ability of the person to do more difficult tasks rather than his ability to do simple tasks more rapidly.

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Mentimeter No. 11
MEMORY FOR NUMBERS

Character of the Test.

This test is planned as an individual examination to be given to any candidate who understands the English language. The test is borrowed directly from the Binet series and was used as a group test in the first form of the Alpha examination in the United States Army.

The usefulness of this test is probably limited to the selection of candidates for very simple mechanical operations and to the classification of pupils in the schoolroom. It might be employed as one of a series of tests in the selection of telephone operators, but its use in such a case is probably more obvious than practical.

Directions for Giving the Test.

The candidate should be seated comfortably in a quiet place and should be instructed to listen carefully. The examiner should fill out the blanks at the top of the title page, recording only such facts as seem to be necessary. The examiner should then repeat the following formula:

"I am going to read to you sixteen series of numbers. The first series will be very short and the last series will be quite long. When I have read a series I want you to repeat all of the numbers it contained. I shall read them slowly so that you can be sure to get them. Listen very carefully and try not to forget any number. Do not repeat any number until I have finished the whole series and stopped speaking."

The examiner should announce each time just how many numbers will appear in the series. The digits should be read at the rate of one per second, taking care to avoid any rhythmic grouping of the numbers. The examiner should look up expectantly as soon as he has finished reading a series. No in-

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timation should be given a candidate as to whether or not he is being successful. The first series should be read as follows:

"The First Series contains two numbers which are, 5, 6." As soon as the candidate has repeated these numbers the examiner should say:

"The Second Series contains two numbers which are, 2, 7."

First	Series	5	6						
Second	"	2	7						
Third	"	9	3	5					
Fourth	"	4	1	6					
Fifth	"	7	4	9	3				
Sixth	"	4	8	5	7				
Seventh	"	9	5	7	3	8			
Eighth	"	6	8	1	2	4			
Ninth	Series	2	6	8	3	5	9		
Tenth	"	6	3	5	9	2	7		
Eleventh	"	9	5	8	3	6	2	4	
Twelfth	"	8	1	9	5	2	6	3	
Thirteenth	"	3	5	2	6	8	3	4	9
Fourteenth	"	2	8	5	9	3	6	1	4
Fifteenth	"	6	3	9	4	8	1	7	2	5
Sixteenth	"	7	1	4	9	6	3	5	2	8

Directions for Scoring the Test.

The examiner should keep on the test leaflet, out of the sight of the candidate, a notation of exactly which series cause failure. Misplacement of any digit in the series should count as an error and bring no credit for that series. The total score obtained by counting the number of series in which each number was correctly repeated in its right order should be written in the lower right-hand corner of the title page of the leaflet.

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Scores from	0	to	7	indicate	Inferior Ability
" "	8	"	9	"	Low Average Ability
" "	10	"	12	"	Average Ability
" "	13	"	14	"	High Average Ability
" "	15	"	16	"	Superior Ability

MENTIMETER No. 12

REPEATING NUMBERS BACKWARD

Character of the Test.

This test can only be given as an individual examination and to people who understand spoken English. The presence of other people in the room where the test is being given is frequently the cause of low scores.

This test is borrowed bodily from the Binet series, in which it has won a distinct place for itself as a useful measure of the ability to think about symbols and abstract ideas.

This test will be of little value as an entertainment feature but will be useful to the public school teacher, or to the employer who wishes to have a brief but fairly accurate test to apply to individual people whom he may be considering for positions of responsibility. The reliability of the test is unusually high for an examination taking no more time than is required for this.

Directions for Giving the Test.

The examiner should read the following instructions clearly:

"I have twelve lists of numbers to read to you. I want you to listen carefully as I read each list, and when I say 'Now' you are to repeat the same numbers backward, that is, in the reverse order. For example, if I should read the numbers, 3, 4, 5, when I said 'Now' you should repeat them 5, 4, 3. If I read 9, 8, 7, you should say 7, 8, 9. You are to say the same numbers I read, but you are to say them just backward from the way I read them."

The examiner should read each series very distinctly and at

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the rate of one digit per second. About five seconds before the reading of each series the examiner should call the candidate's attention by saying, "Now listen to this set." Allow two seconds after reading the last digit of each series before saying "Now," or, "Now say them backward." If the candidate has not begun to repeat the digits within thirty seconds the examiner should say "Now try this set" and should read the next list to him.

First	Series	5	8					
Second	"	6	4					
Third	"	3	5	2				
Fourth	"	8	4	9				
Fifth	"	7	3	9	4			
Sixth	"	5	2	6	8			
Seventh	"	1	9	2	5	3		
Eighth	"	4	2	8	9	6		
Ninth	"	8	3	6	2	5	7	
Tenth	"	1	5	9	6	4	7	
Eleventh	"	2	6	3	7	5	8	4
Twelfth	"	3	8	2	6	4	7	5

Directions for Scoring the Test.

The score in this test is the number of series repeated backward without error. Any misplacement in the order of the digits should be considered an error and no credit should be given for that series. The examiner will need to keep a record of just which series were correctly repeated, and will need to keep this record from the view of the candidate being examined, at least until after the examination is complete.

Scores from		0	to	4	indicate	Inferior Ability
"	"	5	"	6	"	Low Average Ability
"	"	7	"	8	"	Average Ability
"	"	9	"	10	"	High Average Ability
"	"	11	"	12	"	Superior Ability

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MENTIMETER No. 13
MEMORY FOR SENTENCES

Character of the Test.

At the age of two years and frequently before, the vocabulary of the ordinary child has developed to such an extent that it contains two or three hundred individual words which can be used rather effectively. By the time the child is four years of age he has increased his vocabulary very extensively and can repeat entire sentences, if they are not too long, without error. The Mentimeter here provided is intended to measure the complexity and length of a sentence which an individual can repeat correctly after having heard it only once. The reliability of this test is not very well determined and its field of usefulness is almost as indefinite. It will be interesting in social groups as a recreation and will be useful to the teacher in comparing her pupils, but it is doubtful if it can be employed in industrial work with any large group of employees. It would seem that it might, however, be found valuable as a test of telegraphers, stenographers, and dictaphone operators. The fact that it is to be given as an individual test still further limits its usefulness.

Directions for Giving the Test.

The examiner, after recording or having the candidate record on his leaflet the identifying information required, should repeat the following explanation:

"I have ten sentences which I shall read to you slowly, one sentence at a time. You are to listen very carefully while I read and then after I have finished reading a sentence you are to repeat it to me exactly as it was read."

Each sentence should be read only once. The reading should be done slowly and distinctly with sufficient emphasis to make clear the meaning of the sentence as well as the words spoken. The candidate should be encouraged to try each sentence and

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should not be informed as to whether or not his attempts are successful. The sentences to be read are as follows:

1. It snows in the winter.
2. Men usually have more dignity than boys.
3. There is no excuse for being thoughtless about the rights of other people.
4. The price of peace may sometimes be much greater than a nation can afford to pay.
5. It is unfortunate that war should ever be necessary among civilized nations.
6. Their harbour is a shallow body of water connected with, but protected from, the open sea.
7. Conscience asserting itself as the voice divine within the human soul is then a real actuality.
8. Each state appoints a number of electors equal to the whole number of senators and representatives.
9. These discoveries—gunpowder, printing-press, compass, and telescope—were the weapons before which the old science trembled.
10. The use of italic type is indicated in the author's manuscript by underscoring the letters, words, phrases, or sentences that are to be italicized.

Directions for Scoring the Test.

The candidate is to be scored as successful on each sentence repeated correctly, or repeated with the omission of not more than one unimportant word such as "the" or "a." The omission of more than one word or of a word which changes or limits the meaning of the sentence should be considered as a failure to remember what was said.

The examiner should keep on the test leaflet a note of just which sentences were correctly repeated and which were not. The candidate should not be allowed to see or know his record.

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The total score is the number of sentences on which the candidate was successful.

Scores from	0 to 2	indicate	Inferior Ability
"	3 " 4	"	Low Average Ability
"	5 " 6	"	Average Ability
"	7 " 8	"	High Average Ability
"	9 " 10	"	Superior Ability

MENTIMETER No. 14
SPEAKING-VOCABULARY TEST

Character of the Test.

One of the best measures of the intellectual capacity of a community or of a race of people is the complexity of the language which they find it necessary to use in their life and social intercourse. The speaking vocabulary of a tribe or of an individual is therefore an unusually accurate index of mental capacity. The present test of speaking vocabulary is designed to be used as an individual test for measuring the vocabulary of English-speaking persons. With some alterations in the directions which are given below the test might be used as a group test, but the results from such a group test would be quite different and practically not comparable with the results to be obtained when the test is given according to directions.

The individual to be examined need not be able to read English but must be able to understand ordinary conversational words and sentences. The examiner pronounces very distinctly the word which appears on his list and asks the candidate to explain the meaning of the word. The list used by the examiner contains fifty words, which are roughly graded, from the most common and well-known words used in every-day life up to very unusual and little-known words that would be found very rarely in newspaper or magazine articles. Any definition is accepted which shows that the candidate really understands the nature and use of the thing mentioned.

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This test is modelled directly upon the Vocabulary test included in the Stanford Revision of the Binet tests. It has been shown by careful scientific investigations that a test of this type is very reliable as a measure of general intellectual capacity. The excuse for having, at the end of the series, words which are little known and of no great practical value is that without such words it would be impossible to obtain a real measure of the vocabulary of writers, well-trained lawyers, and other specialists in the use of the English language. The good scientific test of intelligence always begins with elements which are so simple that the dullest mind will master them and progresses steadily to elements which are so complex and difficult that even the keenest minds have difficulty in reaching satisfactory solutions.

A test of this sort measuring general vocabulary will be very useful to employers in the selection of stenographers and other clerical workers. In the public schoolroom teachers will find it very helpful in the classification of new pupils coming to their room for the first time or in the comparison of pupils who have been observed for a long period. The disadvantage of the test is that it must be given to one individual at a time. Such procedure makes it possible, however, for the teacher or the psychologist to study the more or less intangible attitudes and reactions of the pupil which cannot be observed in group examinations. These peculiarities of the pupil are of tremendous value to the trained psychologist or to the psychiatrist in making a careful diagnosis of special mental defects.

Directions for Giving the Test.

This test should not be given in the presence of outsiders. The examiner should take the individual to as quiet a place as possible, should seat the candidate in a comfortable chair, and converse with him until he is thoroughly at ease and ready to answer any sort of question. The examiner may write on his list the response which is made by the candidate to each word in the vocabulary. The formula which should be used by the

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examiner should be as nearly as possible that of ordinary conversation, although care must be used to avoid suggesting by the form of the question any clue to the proper response. Beginning with the first word, after introducing the general idea by some such phrase as "Now, I am going to ask you the meanings of a list of words," the examiner should say, "The first word is coat. What is a coat?"

If the candidate does not seem to understand, the question may be repeated or it may be presented as follows: "You know what a coat is, do you not? Well, what is a coat?"

Similarly, with the second word one could say, "What does the word buy, b-u-y, mean? What is the meaning of buy?" If the candidate does not understand, the question may be restated as follows: "Did you ever buy anything? What does the word *buy* mean?" Special care should be taken at all points to avoid suggesting the answer, giving special hints, discouraging the candidate or telling him whether or not he is being successful. He may be told at any time that he is doing well but he should not be informed whether his answer is correct or incorrect.

Not more than forty-five seconds should be allowed to the candidate for thinking about any one word. At the end of the forty-five seconds the examiner should repeat the question. If at the end of thirty seconds after the question is first repeated the candidate has still said nothing, the examiner should pass on to the next word with this introduction, "Well, here is another word. What does the word 'book' mean?" Under no circumstances should the candidate being examined be allowed to take or to see the word list.

Speaking-Vocabulary Test.

1. coat
2. buy
3. book
4. store
5. piano
6. rent
7. beef
8. law
9. disease
10. doubt

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11. judge
12. fortunate
13. secretary
14. royal
15. canal
16. greed
17. blond
18. wealth
19. permit
20. wisdom
21. govern
22. license
23. compete
24. Jupiter
25. modesty
26. policy
27. measure
28. enthusiasm
29. percentage
30. league
31. socialism
32. logic
33. revere
34. sarcasm
35. taunt
36. opaque
37. débutante
38. reparation
39. decimate
40. rheostat
41. omniscient
42. beshrew
43. cheetah
44. behemoth
45. oriel
46. megalith
47. myelin
48. paleography
49. prosthetics
50. salep

Directions for Scoring the Test.

The score of this test is the number of words which the candidate demonstrates clearly that he understands and can use. A list is provided in the appendix showing the chief meanings and uses which are likely to be mentioned by the candidate. A repetition of a word by the candidate should not be counted as evidence that he understands. For example, the candidate who replies that "doubt" means "when you doubt something" or that "greed" means "when you are greedy" has not fully proved by such a reply that these words are familiar to him. In such cases as those just mentioned the examiner may well ask, "Does it mean anything more to you?"

The best method of keeping record is to write on the test blank a notation of what reply was received, although it will

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be sufficient to make a check mark after each word satisfactorily explained and to cross out each word that is unknown if from his reply there is no doubt about the ability of the candidate to use the word. The maximum score obtainable in this test is fifty words. The score actually received should be entered on the title page of the test blank for purposes of record.

Scores from	0	to	10	indicate	Inferior Ability
"	" 11	"	20	"	Low Average Ability
"	" 21	"	30	"	Average Ability
"	" 31	"	40	"	High Average Ability
"	" 41	"	50	"	Superior Ability

MENTIMETER No. 15

WORD DISCRIMINATION

Character of the Test.

Intellectual ability has usually been attributed in the greatest degree to those people who were best able to use their native language. This test is calculated to measure the ability of individual candidates to discriminate between the meanings of different words. Insofar as ability to draw distinctions between similar words can be taken as a measure of intellectual capacity, this test will be found useful.

It is quite certain to be entertaining as a social diversion and distinctly useful as a measure of the general familiarity of any child in the public schools with the English language. Industrial and commercial establishments may very well find that it has a distinct relationship to the kind of intelligence it would pay them to employ in certain parts of their organization.

There is no simple way of converting this test into a group test because of the added complexity of the problem which is presented when candidates are asked to write their answers. It is very much simpler to explain the difference between two words

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than to write out the explanation. It is recommended that this test be given in a quiet place where no persons other than the examiner and the candidate are present. This rule, of course, will not apply when the test is used as a parlour game.

Directions for Giving the Test.

The examiner should use the regular printed leaflet which contains the list of words to be explained. On the title page, he should enter such facts about the candidate as will identify him and satisfy the purposes of the investigation. The word list should not be shown to the candidate at all. The examiner should make a notation on his word list showing just what difference was mentioned by the candidate for each pair of words.

When the examiner has put the candidate at his ease and is ready to begin the test, he should read the following directions: "I have a list of twenty-four pairs of words. I shall read one pair at a time, and I wish you to tell me what differences you know between the two things mentioned. First, what is the difference between a bird and a fish?" If no answer is given within half a minute, the examiner may say: "You know what a bird is, do you not? You know what a fish is, don't you? Well, what is the difference between a bird and a fish?" No additional help of any sort may be given and not more than thirty seconds should be allowed after the second asking of the question. The only formula to be used is: "What is the difference between —— and ——?"

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What is the difference between

1. A bird and a fish?
2. A snake and a fly?
3. A pen and a pencil?
4. An eagle and a chicken?

5. A book and a magazine?
6. An orange and a lemon?
7. A teacher and a preacher?
8. Luck and pluck?

9. Stone and china?
10. A balloon and an airplane?
11. To plod and to plot?
12. To wither and to shrivel?

13. To surprise and to astonish?
14. Rash and reckless?
15. Lonely and solitary?
16. Sorrow and sadness?

17. Plutocrat and autocrat?
18. A rascal and a rogue?
19. To plunder and to devastate?
20. To relinquish and to resign?

21. Shrewd and sagacious?
22. Dormant and quiescent?
23. Reconstruction and rehabilitation?
24. Reparation and indemnity?

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Directions for Scoring the Test.

The score in this test is the number of pairs of words between which the candidate gives at least one real difference. The differences which appear in Appendix D are suggestive of the type of differences which may be mentioned by the candidate, but the list there furnished is not complete. One should not assume that the candidate knows the difference between the two things for which the words stand until the candidate has described one real difference pretty clearly. Such answers as, "Oh, they are different, entirely different," or "One is one thing and the other is something else" should not be considered as correct in any respect. The idea that the person knows a difference without being able to explain it should not influence in any way the judgment of the examiner. The difference must not only be known, but must be clearly expressed before credit is given for any pair.

The total score possible in this test is twenty-four points. The total score actually made by any candidate should be entered in the lower right-hand corner of the title page of the leaflet.

Scores from	0	to	4	indicate	Inferior Ability
" "	5	"	9	"	Low Average Ability
" "	10	"	16	"	Average Ability
" "	17	"	20	"	High Average Ability
" "	21	"	24	"	Superior Ability.

Mentimeter No. 16

NAMING OPPOSITES

Character of the Test.

The Opposites test in one form or another has been used for a long while with remarkable accuracy as a measure of one's familiarity with language and his general intellectual competence. The Mentimeter form is superior to the ordinary form of the Opposites test in that it is fairly well graded in its difficulty, from simple problems to very difficult problems, thus

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securing an added value as an intelligence test. It differs from the Alpha form used in the Army in that it is necessary in the Mentimeter test to write the word which is the opposite of the key word given, while in the Army two words were given which might be opposites or synonyms and the soldier was asked to check whether the words meant the "same" or the "opposite." One difficulty with the military form was that if a man knew nothing at all about the words used, he would, nevertheless, by chance have half of his answers correct. In the present Mentimeter form, a man must not only use his judgment to decide between two words but he must have fairly rich associations between the key word and its opposites and be able to select from all of these associations the one which is most appropriate.

This test may be given as an individual examination, but it is planned as a group examination for as many candidates as can be conveniently seated in the room provided for the examination. Only persons who can read and write the English language should be tested with this Mentimeter.

Directions for Giving the Test.

As soon as the blanks on the title page of the booklet have been correctly filled in, under the direction of the examiner, the candidates should be asked to read silently the directions printed below these blanks while he reads them aloud: "When you open your booklets, you will find on the inside forty words each followed by a dotted line on which you are to write a corresponding list of forty words. You are to write after each word the word which in your mind means just the opposite to the word that is printed. Notice the three samples printed below:

On the line after each word, write the word which means just the opposite of the printed word.

(Samples) A. bad ..... *good*

B. girl ..... *boy*

C. down ..... *up*

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"The opposite of bad is 'good' and therefore 'good' has been written after the word 'bad'; the opposite of 'girl' is 'boy' and therefore the word 'boy' has been written after the word 'girl'; the opposite of the word 'down' is 'up' and therefore 'up' has been written after the word 'down'.

"You will be allowed exactly four minutes in which to write the opposites of as many words as you know in the list. Begin with the first word. Ready! Open your books! Go to work!"

Exactly four minutes after saying "Go!", the examiner should call, "Stop! Close your books and hand them to me!" The papers should be collected immediately.

On the line after each word, write the word which means just the opposite of the printed word.

1. good .....
2. rich .....
3. little .....
4. new .....
5. hard .....
6. dark .....
7. dirty .....
8. sick .....
9. north .....
10. empty .....
11. push .....
12. wrong .....
13. beginning .....
14. narrow .....
15. morning .....
16. nowhere .....
17. stale .....
18. busy .....
19. to float .....
20. smooth .....
21. wild .....
22. strength .....
23. innocent .....
24. wisdom .....
25. positive .....
26. inferior .....
27. ancient .....
28. result .....
29. stingy .....
30. abstract .....
31. partiality .....
32. diligent .....
33. frugal .....
34. spurious .....
35. elation .....
36. expedite .....
37. diffident .....
38. homogeneous .....
39. intrepid .....
40. sycophantic .....

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Directions for Scoring the Test.

The score in this test is the total number of words for which the exact opposite has been written. Some considerable time will be saved by using the stencil provided with each package of test booklets. The total score as finally obtained should be written in the lower right-hand corner of the title page of the booklet.

Scores from	0	to	7	indicate	Inferior Ability
"	8	"	12	"	Low Average Ability
"	13	"	25	"	Average Ability
"	26	"	32	"	High Average Ability
"	33	"	40	"	Superior Ability.

Mentimeter No. 17

SPELLING TEST

Character of the Test.

All of the investigations which have been made into the subject of spelling in relation to general intelligence seem to indicate that good spellers are "born and not made." Of course intelligent people also are "born and not made." Strange to say, a person may be very intelligent without being an expert speller or a person may be a fairly able speller without being keen intellectually. This Mentimeter is therefore not to be considered as reliable an index of intelligence as most of the others.

There are two methods by which one might determine the ability of any average individual in spelling. One might measure how difficult a word was necessary in order to cause failure or one might take words all of the same difficulty and measure what percentage of them were misspelled by the candidate. List A in the series which follows is of the first sort, measuring how difficult a word must be before it causes trouble and List

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B is of the second sort, measuring how many words of the same difficulty can be spelled correctly by the individual tested. These words are selected from the Ayers Measuring Scale for Ability in Spelling. Mentimeter List A consists of two words from each degree of difficulty from B to Z in the Ayers list. Mentimeter List B is chosen from List R of the Ayers Scale.

Directions for Giving the Test.

Whether the examination is to be with List A or with List B the candidates should be supplied with the Mentimeter leaflet and should be asked first of all to write their names, ages and other necessary information on the title page. When this information has been obtained the examiner should read the following directions:

"I shall pronounce to you a list of fifty words. You are to listen carefully and then to write on the blank provided for it the word which I pronounce. Be very careful to form your letters distinctly in order that I may know whether or not you know how to spell these words. Do not ask any questions, for I shall not answer them. Each word will be pronounced only twice, so listen carefully in order not to make it necessary to ask for a further repetition."

The examiner should pronounce each word very distinctly. He should, before pronouncing the word, give the serial number of the word in order that it may be recorded on the proper blank by the candidate. The formula to be used should be as follows:

"The first word is 'go,'—go." After waiting for ten or not more than fifteen seconds, the next word should be pronounced as follows: "The second word is 'at,'—at."

It is the intention that each individual shall have ample opportunity to understand the word to be spelled and to write his spelling of it, but that the conditions shall remain uniform for all.

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List A

1. go
2. at
3. can
4. run
5. ten
6. bed
7. good
8. little
9. like
10. book
11. make
12. hand
13. tell
14. five
15. spring
16. plant
17. game
18. hard
19. week
20. mile
21. summer
22. express
23. railroad
24. ticket
25. death
26. learn
27. district
28. pleasure
29. prison
30. family
31. factory
32. president
33. illustrate
34. education
35. century
36. difference
37. organize
38. estimate
39. foreign
40. difficulty
41. reference
42. secretary
43. athletic
44. February
45. preliminary
46. annual
47. decision
48. principle
49. judgment
50. recommend

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LIST B

1. Christmas
2. interest
3. popular
4. treasure
5. search
6. complete
7. against
8. consider
9. tomorrow
10. general
11. distribute
12. injure
13. service
14. article
15. feature
16. manner
17. increase
18. convention
19. together
20. diamond
21. common
22. purpose
23. director
24. attention
25. already
26. according
27. provision
28. object
29. different
30. prefer
31. busy
32. vessel
33. prepare
34. wreck
35. promise
36. illustrate
37. secure
38. adopt
39. success
40. toward
41. machine
42. publication
43. visitor
44. salary
45. entertain
46. wear
47. education
48. avenue
49. combination
50. forenoon

Directions for Scoring the Test.

No word should be given credit unless it is spelled correctly. If a word is so illegible that the examiner cannot easily tell whether or not it is correctly spelled it should be counted as wrong. The total number of words correctly spelled should be entered in the lower right-hand corner of the title page of the

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test leaflet, and should be followed by a notation of the list used.

In List A

Scores from	0	to	20	indicate	Inferior Ability
" "	21	"	35	"	Low Average Ability
" "	36	"	45	"	Average Ability
" "	46	"	50	"	High Average or Superior Ability

In List B

Scores from	0	to	10	indicate	Inferior Ability
" "	11	"	24	"	Low Average Ability
" "	25	"	40	"	Average Ability
" "	41	"	46	"	High Average Ability
" "	47	"	50	"	Superior Ability

It is not to be expected that an individual's score will be the same exactly in List A as in List B or that his classification based on this score will be just the same. The two lists are not perfectly adjusted in this matter and if they were it would still be possible for a person of "Average Ability" in List A to obtain "Low Average" scores in List B.

In public school work teachers will probably find List A more instructive than List B, although List B will be almost as useful in classifying pupils, especially when used in connection with the following table of average results.

The average	Second	Grade	pupil	should	spell	6	words	in	List	B
" "	Third	"	"	"	"	14	"	"	"	"
" "	Fourth	"	"	"	"	25	"	"	"	"
" "	Fifth	"	"	"	"	33	"	"	"	"
" "	Sixth	"	"	"	"	40	"	"	"	"
" "	Seventh	"	"	"	"	44	"	"	"	"
" "	Eighth	"	"	"	"	47	"	"	"	"

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MENTIMETER No. 18

RANGE OF INFORMATION

Character of the Test.

This test is a very entertaining and useful task for any group to work upon. It is based upon the assumption that general intelligence will result in the extension of one's general knowledge and information about affairs in many fields. The test requires, for its perfect solution, knowledge of all sorts of facts in a great variety of fields.

The General Information test used in the Army Alpha series was very frequently subject to criticism from officers and men because not a sufficient number of questions was asked about matters which pertained to their own field of work. The physicians, for example, expressed regret that there were so few questions referring to medicine or anatomy, while the engineers were just as much inclined to believe that the test would have been improved had it included a larger number of questions applying directly to their field. Of course the purpose of the test is to avoid specializing in any particular field and to cover just as wide a range as possible of general information.

An effort has been made to graduate the difficulty of the questions asked in the Mentimeter form of this test, in order to obtain as much additional merit as possible in the measurement of intellectual capacity. This test will be useful in almost any educational or industrial organization. It is probable, however, that its usefulness in school will not be as great as in life outside of the schools. As little of the material has been drawn from educational experiences as seemed possible. A great deal of amusement can be obtained in a social group by reading aloud the answers checked by members of the group.

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Directions for Giving the Test.

When the candidates are comfortably seated and provided with pencils, the examiner should distribute the booklets to them with the request that they be not opened until directions are given. When the information blanks on the title page have been filled out satisfactorily, the examiner should ask the candidates to read silently the directions printed on the title page while he reads them aloud.

"On the inside of this booklet, when you are told to open it, you will find 40 different sentences, at the end of each one of which there is a list of words from which you are to choose the proper one to be the last word. When you are told to turn the page, begin with the first sentence and make a check mark (✓) in the little square in front of the best word to use as an ending. Choose the word which will make the truest sentence. Choose only one word for each ending. If you are not absolutely certain which is the most truthful, make a guess and try the next sentences. Ready! Go!"

(FOR TESTS SEE PAGES 204-207)

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Make a check mark (√) in the square in front of that one of the four words which makes the best sentence and tells the most exact truth.

1. The JERSEY is a kind of ☑ COW ☐ DOG ☐ CAT ☐ HORSE

2. GOLF is played with ☐ CARDS ☐ DICE ☑ CLUBS ☐ BUTTONS

3. FATIMA is the name of a ☐ CIGAR ☐ CLOTH ☐ PIPE ☑ CIGARETTE

4. A SAW is used by a ☐ PAINTER ☐ PLUMBER ☑ CARPENTER ☐ PLASTERER

5. An EMERALD is ☑ GREEN ☐ RED ☐ BLUE ☐ BLACK

6. DETROIT is noted for its ☐ BREWING ☐ TEXTILES ☑ AUTOMOBILES ☐ PRINTING

7. A SPANIEL is a kind of ☐ SHEEP ☐ GOAT ☑ DOG ☐ MULE

8. MAUDE ADAMS is noted as a ☐ DANCER ☑ ACTRESS ☐ NURSE ☐ WRITER

9. CANDY is made by ☐ FORD ☑ HUYLER ☐ COLGATE ☐ MACMILLAN

10. The CIVIL WAR began in ☐ 1848 ☑ 1860 ☐ 1861 ☐ 1865

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Make a check mark (✓) in the square in front of that one of the four words which makes the best sentence and tells the most exact truth.

11. The SHERIFF is an officer of the ☐ CITY ☑ COUNTY ☐ STATE ☐ NATION

12. RUBENS is famous as a ☐ POET ☐ SCIENTIST ☐ CARTOONIST ☑ PAINTER

13. The HARLEY DAVIDSON is an ☐ AUTOMOBILE ☐ AËROPLANE ☑ MOTORCYCLE ☐ KITE

14. MEREDITH NICHOLSON is a ☐ HUMORIST ☑ NOVELIST ☑ POET ☐ MUSICIAN

15. BUILT LIKE A SKYSCRAPER is an "ad" for a ☐ BED ☐ TRUNK ☑ FILING-CASE ☐ STOVE

16. The KILOMETER measures ☐ ELECTRICITY ☐ DISTANCE ☑ GAS ☐ WATER

17. The TIBIA is in the ☑ LEG ☑ ARM ☐ CHEST ☐ HEAD

18. CORAL is found in ☐ TREES ☑ REEFS ☐ MOLLUSKS ☐ MINES

19. CLYSMIC is a kind of ☐ WINE ☐ CLOTH ☐ WATER ☑ METAL

20. UNCLE TOM'S CABIN was written by ☐ POE ☑ STOWE ☐ HAWTHORNE ☐ IRVING

(over)

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Make a check mark (✓) in the square in front of that one of the four words which makes the best sentence and tells the most exact truth.

21. JOHN HAY was a ☐ BANKER ☐ ENGINEER ☐ PREACHER ☑ STATESMAN

22. VASSAR COLLEGE is at ☑ POUGHKEEPSIE ☐ ITHACA ☐ BOSTON ☐ CAMBRIDGE

23. A SUBPOENA is used in ☐ INSURANCE ☐ MEDICINE ☑ LAW ☐ WAR

24. The number of a BANTU'S legs is ☐ ONE ☐ TWO ☑ FOUR ☐ EIGHT

25. SAMPSON BRASS is a character in ☐ SCOTT ☐ POE ☐ DICKENS ☑ BURNS

26. The HANDLEY-PAGE plane is made in ☐ FRANCE ☐ JAPAN ☑ ENGLAND ☐ AMERICA

27. The FALCON is an ☐ INSECT ☑ BIRD ☐ TOOL ☐ STONE

28. DRIBBLE is a term used in ☐ HUNTING ☐ THEOLOGY ☐ LAW ☑ ATHLETICS

29. PHEZ is a ☐ FABRIC ☐ DANCE ☐ GAME ☑ DRINK

30. HIGGINS manufactures ☐ FURNITURE ☐ BOOKS ☐ GLASSWARE ☐ INK

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Make a check mark (√) in the square in front of that one of the four words which makes the best sentence and tells the most exact truth.

31. GUAVA is a kind of ☐ FISH ☐ BIRD ☐ ANIMAL ☑ FRUIT

32. An EQUILATERAL TRIANGLE is also ☐ RIGHT ☐ ISOSCELES ☐ SCALENE ☑ ACUTE

33. The BATTLE OF HASTINGS was in ☐ 1066 ☐ 1215 ☐ 1453 ☑ 1607

34. The AORTA originates in the ☐ HEAD ☐ FEET ☐ ALPS ☑ HEART

35. ENDIVE is a kind of ☐ STONE ☐ TOOL ☑ PLANT ☐ ANIMAL

36. SEOUL is in ☐ PERSIA ☑ KOREA ☐ INDIA ☐ SYRIA

37. JOSEPH PRIESTLEY discovered ☐ PONGEE ☐ AUSTRALIA ☑ OXYGEN ☐ PRINTING

38. The OBOE is used in ☑ MUSIC ☐ MEDICINE ☐ GEOLOGY ☐ RELIGION

39. CHALLIS is a kind of ☐ DISH ☐ DRINK ☑ DANCE ☐ CLOTH

40. A RHESUS is a kind of ☐ FISH ☑ BIRD ☐ ANIMAL ☐ REPTILE

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At the end of four minutes the examiner should call "Stop! The time is up!" He should use care to see that no answers are checked after the signal to stop has been given.

Directions for Scoring the Test.

The score in this test is the number of sentences in which the right conclusion has been checked. Credit should not be given for checking any other word than the correct one. The use of the stencil, which is provided with each package of test booklets, will save a great deal of eye strain, mental fatigue, and time in marking these tests. This stencil makes it possible for an ordinary clerk to score the 40 sentences accurately in a fraction of a minute.

The total score in the test should be entered at the lower right-hand corner of the title page of the test booklet.

Scores from	0	to	3	indicate	Inferior Ability
" "	4	"	10	"	Low Average Ability
" "	11	"	23	"	Average Ability
" "	24	"	30	"	High Average Ability
" "	31	"	40	"	Superior Ability

Mentimeter No. 19

READING VOCABULARY

Character of the Test.

One of the most valuable measures of any individual or group of individuals is the extent of the vocabulary found necessary for communication and social activities. The Vocabulary test which is used in connection with the Stanford Revision of the Binet test, and which is quite similar to Mentimeter No. 14, has been shown to be unusually reliable as a measure of general intelligence. The Reading-Vocabulary test is probably not so widely usable as the Speaking-Vocabulary test, but it can be

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applied as a group test and is therefore probably destined to much more extensive usefulness than the individual test.

The Reading-Vocabulary test cannot, of course, be given to individuals whose ability in reading is less than that ordinarily possessed by third-grade public school children. The candidate must not only be able to recognize the words that appear in the test and to know their meanings, but he must also be able to classify them as belonging to a particular group of objects. The method of the test requires the child to make a check mark under the family name which would include the particular word appearing on the vocabulary list. The instructions will not be understood except by fairly intelligent persons, but for those who can understand the instructions and who do their best on the test, a very useful measure will be the result.

Although this test would seem at first glance to be particularly well adapted to the selection of clerical workers, past experience has convinced the writers that it is also useful in the selection of organizers and directors of men as well as of organizers and directors of thought. The relationship between the score in this test and the general efficiency of an employee is unusually high.

Teachers will find the Reading Vocabulary a splendid index of the advancement attained by new pupils coming into their rooms for the first time or of the pupils who have been with them for some time. It is useless to try to have pupils explain the meaning of magazine articles or of selections from their geographies when they do not even understand the words used in these discussions. It would be very much worth while for a teacher, when she has employed this test, to compare the difficulty of the words which cause the majority of her class to stumble and fail with the difficulty of the words used in the ordinary text-books of the school.

In any social group the classification of the forty words in this list would be found rather interesting particularly when the errors made by different members of the group were read aloud for the amusement of the entire group. It should not be sug-

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gested, when the test is to be used in this way, that there is any distinct relationship between achievement in the test and achievement in life, else some of the group will be very much disappointed in their scores.

Every effort should be made to have such a group feel that this was simply a new type of puzzle. The results obtained under such conditions should not be compared with the results obtained under the standard conditions outlined below.

Directions for Giving the Test.

The candidates to be examined should be comfortably seated and provided with well-sharpened pencils. The examiner should then announce that the booklets which he would distribute were not to be opened until instructions to that effect were issued. Booklets should be distributed unopened, one to each individual. Further directions should be issued as soon as each candidate is supplied with the booklet, authorizing each individual to write his name, his age, and such other information as is desirable on the title page of the booklet. When these preliminaries have been finished the examiner should say:

"When I ask you to open your booklet, you will find on the inside a list of forty different words. The test is to determine how many of these words you can read and identify. At the top of the page you will find the words, Animal, Body, Bird, Colour, Clothes, Fish, Time, Tool, and War. Each of the forty words to be identified is connected with or is a kind of Animal, Body, Bird, Colour, or other kind of thing mentioned at the top of the page. The page is ruled both ways. You are to look at each word in the column on the left and to make a check mark at the right of it, under the general word showing whether the word you are marking is an Animal, a Body, a Bird, or something else. You will be allowed exactly four minutes in which to check the words. Mark as many of the words as you possibly can but be sure to check them correctly. Ready! Go!"

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Indicate the meaning of each of the forty words in the column on the left by making a mark (✓) under the proper word.

CONNECTED WITH, OR A KIND OF

	ANIMAL	BODY	BIRD	COLOUR	CLOTHES	FISH	TIME	TOOL	WAR	
arm		✓								1
cow	✓									2
stocking					✓					3
yellow				✓						4
sparrow			✓							5
shirt					✓					6
calf	✓	✓								7
hammer								✓		8
shin		✓								9
saw								✓		10
wren			✓							11
tan				✓						12
cod						✓				13
troops									✓	14
year							✓			15
conquer									✓	16
stag	✓									17
minnow						✓				18
month							✓			19
kimono					✓					20
rampart									✓	21
thigh		✓								22
carmine				✓						23
partridge			✓							24
sturgeon						✓				25
ratchet					✓					26
interim							✓	✓		27
peccary			✓							28
mauve				✓						29
citadel									✓	30
ephemeral								✓		31
tartan						✓				32
peritoneum		✓								33
petrel			✓							34
tench										35
vomer										36
burgonet										37
burin										38
desman										39
tinamou										40

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At the end of exactly four minutes the examiner should call "Stop! Time up! Close your papers and hand them to me." All papers should be collected at once.

Directions for Scoring the Test.

The total score in this test is the number of words correctly checked. The work of checking the accuracy of marks made by the candidates is very much simplified by the stencil which accompanies each package of examination booklets. This stencil indicates exactly where a check should be made in each case.

The total number of words correctly checked should be entered in the lower right-hand corner of the title page of the examination booklet.

Scores from		0	to	8	indicate	Inferior Ability
"	"	9	"	14	"	Low Average Ability
"	"	15	"	24	"	Average Ability
"	"	25	"	29	"	High Average Ability
"	"	30	"	40	"	Superior Ability

MENTIMETER No. 20

READING: DIRECTIONS

Character of the Test.

In the United States Army an officer frequently calls one of his orderlies to his desk and issues orders somewhat as follows: "Present my compliments to Lieutenant Smith and ask him to report at my office to-morrow afternoon at 3.15 for his orders regarding the disposition of garbage from the kitchen of Company E. Tell Corporal Jones in Barracks 17 to take a detail of four men and report at 5.00 o'clock this evening to Sergeant Katz at the Second Battalion Officers' Mess. Deliver this package to the Adjutant of the Base Hospital and ask him to let me

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know at once what should be done with the S. C. D. papers brought to me this morning by Lieutenant Johnson." The orderly must be able to carry out these orders without their repetition or explanation. He should reply, "Yes, sir," by way of making it clear that he has understood and will obey the directions, but should say nothing more.

The first test in the Alpha series used in the Army was intended to measure how complicated a series of directions could be grasped by the soldier and executed without errors. The Mentimeter test differs from its military counterpart in that the directions are to be printed rather than spoken, and in that the increasing difficulty arises from the increasing complexity and obscurity of the words employed rather than from the length of the directions to be held in mind. Whether these changes will increase or decrease the value of the test cannot be stated in advance of actual trials.

Directions for Giving the Test.

As soon as the candidates have been provided with pencils, writing surfaces, and comfortable seats, the examiner should distribute the examination leaflets with the instruction that the blanks at the top of the title page be filled out at once and that no one should turn the leaflet until the direction to do so be given.

The test should be introduced by the request from the examiner that everyone look at the directions on the title page while they are being read aloud, "When you are told to turn your leaflet and go to work, you will find on the other side very full directions as to what you are to do. This is a test to find out how well you can understand directions, so read them carefully and do exactly what they tell you to do. Ready! Turn your leaflets and go to work."

Exactly three minutes should be allowed for this work. At the end of three minutes the examiner should call "Stop! The

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time is up! Turn over your leaflet and hand it to me." The test sheets should be collected at once.

Do what it says.

1. Write your name on this line. .....
2. Make a cross in the square.
3. Make a cross in the circle and a dot in the square.

4. Make a figure 1 under the letter M and a figure 2 under the letter W.

A N W V H M Z U Y

2 1

Do what it says.

5. If Decoration Day comes in the winter, write the word "No." If not, write the word "Yes." .. NO .....
6. Cross out the shortest word in this sentence and draw two lines around the ninth word.
7. Look at the three blanks printed below. On the first blank write the number of days in a week, on the second the number of months in a year, and on the third the number of years in a century.

7 12 100

8. Write in the square on the left the right answer to the question: "How many dimes make a dollar?" In the second square make a small circle, and in the third triangle write the letter "C."

9. If a peck is a greater magnitude than a bushel, cross out the word "pint" unless a pint holds a smaller quantity

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than a quart, in which case draw a line under the first word after bushel.

QUART BUSHEL PECK PINT

10. If a centimeter is more than half as long as an inch, write in the square the number of inches in a yard. If a meter is more than three feet, then write in the circle the number of meters in a kilometer.

11. If the oscillations of a pendulum were not facilitated by any other force than gravity, what would be the effect upon their amplitude? Check the best reply:
It would gradually be

[ ] augmented. [ ] flagellated.
[✓] diminished. [ ] swaged.

Do what it says.

12. If ontogeny invariably ingeminates phylogeny, circumscribe the word giving the location of the OURCQ; if not, underscore the word that locates the MANDIBLE.
England Foot Utah Face Peru France Arm India

Directions for Scoring the Test.

The score is the number of directions which were perfectly obeyed without error. A failure to do any part of the thing directed or the performance of extra things not asked should act to withhold credit for an element. The total number of credits should be entered in the lower right-hand corner of the title page of the test leaflet.

Scores from	0	to	2	indicate	Inferior Ability
"	3	"	5	"	Low Average Ability
"	6	"	8	"	Average Ability
"	9	"	10	"	High Average Ability
"	11	"	12	"	Superior Ability

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Mentimeter No. 21

READING: INTERPRETATION

Character of the Test.

This test is a specially devised method of determining the ability of an individual to secure from the printed page the ideas which are expressed in sentences and paragraphs. It is probable that no single test of reading can be devised which would measure all phases of the subject equally well. This particular test attempts to measure the special ability to interpret the meanings of sentences and paragraphs, although it assumes that the words of which these larger units are composed are recognized and understood by the reader.

The test is arranged with very simple sentences at the beginning followed by more and more difficult sentences until at the last there are statements the meaning of which very intellectual people might fail to grasp at first sight. The questions which are asked regarding the paragraphs likewise increase in difficulty so that the ultimate score obtained by the candidate indicates rather distinctly how difficult are the sentences or paragraphs he is able to understand and answer questions about.

It is not probable that a great field of usefulness will be found for this test in industrial life, although it might very well be used in any establishment where the question of the degree of literacy in the employee was of any importance. Tests fashioned on this order would be tremendously valuable as a basis for classifying according to degree of literacy the immigrants entering this country. Some such objective measure as this is very much needed in the taking of the census. Where at present almost any man or woman who can barely write his or her name is entered on the census records as being able to read and write, the crude examination for literacy which was employed by the psychologists in the U. S. Army illustrates conclusively that about three times as many people are unable to make any practical use of reading and writing as the census

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figures would lead one to believe. It seems certain from the facts obtained in the Army that at least one half of the population of the United States would be unable to answer more than eight of the sixteen questions included in this Mentimeter.

Directions for Giving the Test.

It is particularly desirable that the room in which the test is given should be well lighted and comfortable. Before distributing the tests the usual caution, "Do not open this booklet until you are told to do so," should be given. One test booklet should then be given to each candidate. As soon as all have received their blanks the examiner should give the directions for filling out the information blanks on the title page of the booklet. If very young children or very dull adults are being examined it will be necessary to give specific directions about these blanks. As soon as the blanks are filled the examiner should ask the group to read silently the directions as he reads them aloud.

"When you are told to turn the page you will find on the inside three paragraphs of printed matter. You are to read these paragraphs very carefully and then, turning the page once more, you will find sixteen questions about the three paragraphs you have just read. You are to write the answers to the questions on the blank lines provided for the purpose. You may turn back to the printed matter and look for the answers as often as you need to, but you will only have ten minutes in which to do your reading and the answering of the questions, so be sure to answer all the questions you can. The first questions are easier than those which follow, so answer them in the order in which they come.

"Remember that when I say 'Go' you are to begin reading and to read as fast as you can, then to answer as many questions as you can on the next page. Ready, Go."

Exactly ten minutes after saying "Go" the examiner should call "Stop! The time is up! Close your papers and hand them to me." All papers should be collected at once.

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FIND THE ANSWERS TO THE QUESTIONS BY READING WHAT IT SAYS BELOW

Boys like to run and play in the street. Girls like to stay in the house and play with their dolls. As the girls grow older some of them learn to cook and to help their mothers in the home, while others learn to work in shops, mills, and offices. Some boys learn as they grow up to work on the farms, while others obtain positions in stores, mines, and factories. Even before they grow to be men and women, people differ in the things they enjoy and in the things they are able to do.

It is fortunate that people are so different, for the world has all sorts of work that must be done. Wheat, corn, and cattle must be raised to supply the world with food. Cotton and wool must be made into clothing to keep us warm, while wood and stone must be made into houses to protect us from the rain and the snow. The work of the world requires that some people be farmers, others manufacturers, others merchants, others doctors, and so on. If we were all exactly alike in our tastes and abilities, much of the world's work would have to be done by persons whose inclinations and capacities were in fields of endeavour entirely different from those in which they would be required to labour. The fact that people are so different makes possible an adjustment whereby the ability and interest of the labourer may be in proportion to the difficulty of the undertaking to which he is assigned.

Perhaps nothing makes a larger contribution to the happiness and contentment of the world than this adjustment of the individual to his vocation, and yet the problem of securing such an adjustment is complicated by an enormous number of practical difficulties. One of the most annoying elements in this problem of adjustment has been the impossibility of making expeditiously an effectual classification of candidates according to native capacity and endowment. Psychologists and statisticians have, however, during the past decade evolved methods of intellectual measurement which demonstrate the feasibility and economic utility of the procedure and adumbrate to some extent the social satisfactions that will ensue when the science of personnel engineering has been consummated.

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WRITE THE ANSWERS TO THESE QUESTIONS

1. Who like to play in the street? .....
2. Where do little girls like to play? .....
3. Who learn to help their mothers? .....
4. Where do older boys find jobs? .....
5. In what two ways are people said to differ early in life? .....
6. What kinds of food are mentioned? .....
7. For what purpose do people work with wool and cotton? .....
8. What reason is given for building houses? .....
9. What is the topic of the first paragraph? .....
10. Why are differences between people spoken of in the second paragraph as a wise provision of nature? .....
11. Check the right answer to this question: What does the second paragraph suggest as the probable result upon the world's work if all people were just alike?
    - ☐ It would not be done.
    - ☐ Some of it would be improved.
    - ☐ It would be well done.
    - ☐ Much of it would be poorly done.
12. What characteristic of a task needs to correspond to the ability of the worker? .....
13. What is suggested in the third paragraph as the probable result of failing to place men in positions suited to their abilities? .....
14. It is quite common to determine a man's ability by trying him out in the job. What objection to this plan does any word in the third paragraph suggest? .....
15. What procedure is said to be a practical means of saving time and money in the selection of men for positions? .....
16. What is stated as a probable cause for general gratification at some future time? .....

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Directions for Scoring the Test.

The score in this test is the number of questions correctly answered. A stencil is provided with each set of test booklets by the aid of which it is fairly simple to mark an answer as right or wrong. An answer should be considered wrong if it does not prove in itself that the candidate had read the paragraph and obtained his information from it. Any answer which is true in general life but which is not suggested by the reading material on the previous page, should not be accepted.

Scores from	0	to	3	indicate	Inferior Ability
" "	4	"	7	"	Low Average Ability
" "	8	"	12	"	Average Ability
" "	13	"	14	"	High Average Ability
" "	15	"	16	"	Superior Ability

Mentimeter No. 22

DISARRANGED SENTENCES

Character of the Test.

Publishers and editors have for many years insisted upon having intelligent compositors and type-setters. The printer's pi is probably as comprehensive a test of intelligence as any in the Mentimeter series. In the Binet tests, one of the most interesting parts of the examination is where children are asked to take certain words and rearrange them to make a sentence. This is not exactly the same problem that the type-setter faces with pi, but it is related to it. A disarranged sentence test was used in the military examinations, but in order to make the scoring simple and to include elements of intellectual capacity other than ability to rearrange words, the soldiers were asked to check the resulting sentence as "true" or "false." Here again, without being able to read a single word of the sentences which had been disarranged, the soldiers would be able to make check

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marks in the correct place by mere chance in half the cases. The method of scoring used in the Army was calculated to overcome this difficulty, but even then the results were not as reliable as they should be in the case of the Mentimeter form presented below.

This test contains twenty-five sentences in each one of which the words have been mixed up and disarranged so that a real amount of imagination is necessary in order to guess what the sentence was in the first place. The first sentence contains only three words and is very easily arranged, while the later sentences are quite complicated and difficult. In order to indicate what the true arrangement of the original sentence was, each candidate is asked to place a period at the end of the word which would be last if the sentence were properly arranged. The resulting score may be taken as a fairly reliable index of ability to "unscramble" words in sentences.

This test is very closely related to several of the other tests which appear in the Mentimeter series in that it involves the abllity to think about words and the things for which words stand and the relationships between these words and these things. The type of ability necessary for this test is the sort which makes for success in education and the learned professions, provided social and personal qualities are equal to the intellectual attainments.

This test is also very entertaining as a parlour game and may be used without offense to any one, if no mention is made of the relationship of the results to mental ability.

Directions for Giving the Test.

When the candidates have been seated and supplied with pencils, the examiner should distribute copies of the test booklets with the direction that none be opened until the instruction to do so is given. After having the identifying information called for on the blanks of the title page filled out by the candidates, the examiner should ask that all candidates look care-

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fully at their papers and read silently the directions while he reads them aloud: "A sentence is a list of words which says something that we can understand. When you open the papers, you will find on the inside twenty-five sets of words which are not good sentences as they stand, but which would make good sentences and would sound sensible if they were changed around and put in a different order. Look at the samples given below:

Sample A: KILL MICE CATS
Sample B: HAS BOOK IT PICTURES THE IN

"Sample A would make a good sentence if it were arranged in the order 'CATS KILL MICE' and therefore there should be a period after the word 'mice' to show the end of the sentence. In Sample B, we should have a good sentence if the words were changed around to read: 'THE BOOK HAS PICTURES IN IT.' The end of the sentence is 'it,' and therefore there should be in sample B a period after the word 'it.'

"When you turn the page, begin with the first set of words and study out what the sentence would be, then put a period after the word which would come last. Work right down the page until time is called. You will have two minutes in which to put in the periods of as many sentences as possible. Ready! Open your books! Go to work."

Exactly two minutes after saying the word, "work," the examiner should call "Stop! Close your books! Give them to me." The papers should be collected at once.

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Put a period at the end of the word which would come last if the words on each line were arranged in a sentence.

1. IS WHITE, SNOW 1
2. THE IS BIRD, A ROBIN 2
3. WATER, IN FISH SWIM 3
4. WHITE IN, LIVE HOUSES, PEOPLE 4
5. WITH, TO ARE HEAR EARS OUR 5

6. THE IN SETS WEST, SUN THE 6
7. GOOD FIGHT COUNTRY, SOLDIERS THEIR FOR 7
8. WINTER THE COLDEST, THE ARE MONTHS . 8
9. IS A MILK AND FOOD HEALTHFUL, GOOD . . 9
10. FROM EARTH, DIAMONDS THE MINED ARE . 10

11. FOOD, VALUABLE POTATOES AS ARE A . . . 11
12. AND ON GROW ORANGES TREES, APPLES . . 12
13. FOUGHT FRANCE GERMANY, AND AGAINST ENGLAND 13
14. ALWAYS DEEDS SHOULD BAD PUNISHED, BE 14
15. SEVERAL OCEAN, THE TAKES DAYS CROSS TO IT 15

16. FEW MAKING A IMPOSSIBLE AVOID IT TO IS MISTAKES, ... 16
17. CAN NIGHTS, ON BE MANY NOT THE SEEN MOON 17
18. CLOTHING, USEFUL ARE FOR, AND MAKING WOOL SILK 18
19. BY COMMONLY IS DEBATERS, VERY METHOD IRONY A USED 19
20. EXTREMELY POISONOUS, WARFARE, MANY THE OF ARE IN USED GASES. 20

(over)

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Put a period at the end of the word which would come last if the words on each line were arranged in a sentence.

21. UNFORTUNATE IT MANUAL CONSIDERED IS THAT SOMETIMES LABOUR DEGRADING. 21
22. CERTAIN THE ARE OF AND CRIMES, NAMES BIGAMY LEGAL PERJURY 22
23. THE BETWEEN BY AND ARE DIFFERENCES STUDIED REASONING PSYCHOLOGISTS, HABIT BEING 23
24. MORE TRAITS DESIRABLE CHARACTER STEALING. TIMIDITY OF AND ARE MEEKNESS THAN 24
25. FACT, CAN OBSERVED MAY KIND METHODS TO APPLIED EVERY STATISTICAL THAT BE OF 25

Directions for Scoring the Test.

The score in this test is the number of sentences in which the period has been correctly placed. If a mark appears to be accidental, it should not be held against the credit of the candidate. The stencil provided with the test leaflets simplifies very greatly the marking of this test.

The total number of points credit should be entered in the lower right-hand corner of the title page of the test leaflet.

Scores of	0	to	3	indicate	Inferior Ability
"	4	"	7	"	Low Average Ability
"	8	"	16	"	Average Ability
"	17	"	20	"	High Average Ability
"	21	"	25	"	Superior Ability

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MENTIMETER No. 23
COMPLETION OF SENTENCES

Character of the Test.

This is one of the most satisfactory group tests available for persons with a reading knowledge of the English language. The test consists of a series of sentences in each of which certain words have been omitted. Dotted lines appear at those places where words are missing. The persons being examined are asked to write on the dotted lines the words which have been left out. The blanks left in the sentences are all of the same length in order not to suggest the word to be used. The Mentimeter form of the test contains 20 sentences, graduated in difficulty, from very simple sentences which the average second-grade public school pupil can complete easily, to very difficult sentences which the average college student will be unable to complete satisfactorily within the time limit.

The ease with which one can understand what is to be done in this test makes it particularly useful with children in the elementary schools, and with adults of little education, as a measure of language ability and general intellectual capacity in the manipulation of ideas and words. Although it has been used by many teachers and supervisors as a test of reading ability, it should probably be classified rather as an intelligence test than as an educational measuring instrument. Teachers do not and should not give direct instruction in the art of writing missing words, for almost no situation will arise in practical life where this sort of skill would be necessary.

It is very difficult to determine just what mental powers are tested by the sentence completion test. Quite certainly the result obtained is a complex effect. The person who is successful in this test must first of all be able to read and understand the words which are actually present in any sentence; he must have certain habits of associating other words not present

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with those which do appear; from all of the words which come to his mind as associates of the printed words, he must choose those which fit most aptly the thought expressed; and from those words which would fit into the thought of the sentence he must use good judgment in selecting and writing the one which makes the smoothest and best sentence. Lack of mental ability or of familiarity with the English language will result in a poor showing at almost any step of the process and in a low score in the test as a whole.

This test will probably be found most useful in selecting those commercial and industrial workers who in the course of their work will be called upon to make extensive use of language and printed symbols, although it has been used successfully in many parts of the country in the selection of salesmen, shop foremen, firemen, policemen, and other non-clerical workers. The relationship between success in this test and general success in life is extraordinarily close.

In the public schools this test is particularly valuable as a first means of identifying pupils of unusual ability. Any child who makes five or more points above the average for his grade should be further tested with the Number Series Completion (Mentimeter No. 9) and the Analogies tests (Mentimeter No. 24). If his scores in these tests are distinctly above the average, he should be sent to the psychologist for special examination, and if the psychologist's findings agree with the findings of these tests, as they usually will, then the child should be given special opportunities for rapid progress and more varied activities in school. Similarly, if a pupil obtains a score which is five or more points below the average for his grade, he should be examined with the Completion of Form Series test (Mentimeter No. 6) and the Pictorial Absurdities test (Mentimeter No. 2), and if his scores in these tests are also below the average, he should be referred to the psychologist for special examination and recommendations as to type of instruction best suited to his mental abilities.

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Directions for Giving the Test.

When all candidates have been seated and provided with convenient writing materials, one copy of the examination booklet should be given to each candidate. A general announcement should be given either before distributing the booklets or while they are being distributed, to the effect that no one is to open the booklet or turn it over until directed to do so. The candidates may be instructed to fill out the blanks on the title page if they are intelligent enough to understand what is wanted on these blanks. If young children are being examined, the examiner should state very clearly just what is to be done. For example: "Write your name on the dotted line after the word 'Name.' Write your age at your last birthday on the dotted line which follows the words 'Age at Last Birthday'." Care should be taken that no child gets an unfair advantage by opening his book and beginning work before the following directions have been read aloud by the examiner while the children read them silently from their booklets.

"When you open your booklets you will find on the inside twenty sentences, from each of which one or more words have been left out. You are to guess what words were left out and to write them on the dotted lines which show where these words should be. Be very careful to write the best word you can think of on each blank. Write only *one* word on each of the blanks. Make each sentence sound just as sensible as you can. You will have ten minutes in which to write. Work rapidly and carefully. Ready! Go!"

Exactly ten minutes after saying, "Go!" the examiner should call "Stop! Time up! Give me your papers!" All papers should be collected at once.

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Write only one word on each blank.

1. The dog's name . . . is . . . Jack.
2. Little children go . . . to . . . bed early.
3. The boy . . . gave . . two dollars to the Red Cross.
4. The little . . . girl . . likes . . to . . . play with her dolls.
5. Puppies . . . and . . kittens grow to be . . dogs . . and cats.
6. The best children . . have . . the most friends.
7. One should never . . be rude to his . . mother.
8. The poor . . man . . . was hurt when he slipped and . . . fell . . . on the street.
9. It . . is . . . amusing . . . to . . . watch men chasing their hats on a . . windy . . day.
10. Almost any man . . succeeds . . if he really tries.
11. The elephant is a favourite . . among . . with children because of . . . its . . . size . . . and shape.
12. The . . man . . who . . . carried . . a club and . . wore . . . a uniform was a policeman.
13. . . . . a hot day nothing . . quenches . . thirst so well as a . . . . . of . . . . . water.
14. Marching . . is more than merely . . waving . . a flag and cheering when the soldiers . . are . . . . marching . . home.
15. Anything . . that . . is not . . worth . . doing . . well . . is hardly worth . . doing . . at all.
16. One . . . . not . . . . money to . . . . . worthy charity.
17. . . . . learning a new operation it is sometimes . . . . not to . . . . . all than to practise the . . wrong . . way of . . doing . . it.
18. Those things . . that . . . . no fear . . of . . sometimes . . are . . harmful.
19. . . . . drink . . . . . one is . . . . . is a . . . . . pleasure.
20. . . . . one . . . . . their presence . . . . . not, ... does . . . . . , ... by . . . . . a rule, ... one's guests.

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Directions for Scoring the Test.

The score in this test is the number of sentences completed perfectly within the time limit. No credit should be given for any sentences in which the language is not smooth and meaningful, although errors in spelling should not be counted against the person tested. This test is intended to measure ability to complete sentences rather than ability to spell words. No credit should be allowed unless every blank in a sentence has been properly filled. One error in any one of the blanks will leave the sentence imperfectly done and therefore without credit.

The stencil for scoring this test is less convenient than those furnished with the majority of the Mentimeter tests. The reason for this is the very great possibility of new variations appearing, even after long experience in scoring the test. When more than one blank appears in a single sentence the question as to whether or not a certain word is proper for one of the later blanks depends entirely upon what choice was made in the first blank. It should be held in mind by those who score this test that the stencil does not give all of the possibilities, but only suggests the type of completion which should be considered correct. Anything that is as good as the completions appearing in the stencil should be given full credit, while anything which is not as perfect should be considered incorrect.

The final score obtained by counting the number of sentences perfectly completed should be entered in the lower right-hand corner of the title page of the booklet.

Scores from	0	to	5	indicate	Inferior Ability
"	6	"	9	"	Low Average Ability
"	10	"	16	"	Average Ability
"	17	"	18	"	High Average Ability
"	19	"	20	"	Superior Ability

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MENTIMETER No. 24

ANALOGIES OR MIXED-RELATIONS TEST

Character of the Test.

The Analogies test lends itself easily to wholesale or group administration. It cannot be used with illiterate candidates but requires at least three years of educational background in order to give a satisfactory index of mental capacity. The test blank presents the tasks to be done in a manner so easily understood that little explanation needs to be given orally by the examiner. It is also simple in its method of scoring and yields a very reliable measure of an individual's clearness of thought about the relations of words and the things for which the words stand.

Psychologists have used various forms of this test for many years and have found it unusually accurate and reliable. It is considered particularly valuable as a test of ability to adapt one's self quickly and accurately to new situations, which is undoubtedly one of the most important elements in what is called "general intelligence."

The method of the Analogies test is known as the "controlled-association method." Two words are presented having a very definite relation to each other. A third word is then presented, followed by a blank space upon which the candidate is to write a fourth word which will have the same relation to the third word as the second word has to the first. The relation between the first two or key words in each element of the test differs from the relation between the key words of the previous element, resulting in a constant change in the problem to be solved, which requires quick readjustments in the candidate's thought processes. The candidate must be intellectually alert to discover the true relation between the key words, his mind must be well supplied by experience with words and ideas associated with the third word, and then he must use good judgment and discrimina-

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tion in the selection of that word which has the *proper* relation to the third word. A slip at any of these points will mean failure. The value of the present series as a test of intelligence is greatly increased by the fact that there is a progressive increase in the difficulty of the elements presented, so that the *number* of elements correctly supplied has a very definite relation to the *difficulty* of the tasks the candidate can do.

Because of its relation to intelligence, the Analogies test will be found very useful in the classification of candidates for clerical and administrative positions in industry. Any group of tests selected for classifying such employees should contain a list of graded analogies such as that here supplied. Unless a candidate makes a record of at least fifteen correct responses out of a possible thirty in the three minutes' time allowed in the test. he should be studied very carefully before being entrusted with a task where ideas and symbols must be handled quickly. Such a man might be able to work with things and people, but he will probably be found slow in his grasp of abstract principles and ideas.

In the schoolroom, the Analogies test may be used with some confidence in classifying pupils for instruction. If it is found that a pupil is far below his grade in ability in this test, and if he is also found below his grade in the Completion of Sentences and Number series, it may be assumed that the pupil will probably not succeed in the abstract work of the school. Such pupils should be sent to the clinical psychologist for special study, and a special type of training should be prescribed upon the basis of the psychologist's diagnosis. In the same manner, pupils unusually brilliant in the handling of abstractions may be located through the use of this and other tests of this nature.

The Analogies test is also a very entertaining type of parlour amusement, especially when some of the absurd answers are read aloud for the amusement of the group. When it is so used, however, no suggestion should be made of the relation between

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ability in this test and general intellectual quickness, lest someone should take offence. If the test is given without the exact and formal directions, and if the spirit of fun is introduced by the examiner, certain clever persons are quite certain to write words which have very amusing associations with the words which serve to set the problems in the various lines.

Directions for Giving the Test.

All candidates should be furnished with pencils and writing surfaces—either tables, chair-arms, or writing boards. One test booklet should be supplied to each candidate, the blank being presented unopened and with the title page up. The examiner should announce clearly as the papers are distributed that, "The booklets are not to be turned over or opened up until the signal is given to do so." Candidates should also be directed to sign their names, ages, group numbers, and locations on the blank spaces provided on the cover of the booklet for this information. When each candidate has properly filled out the information blanks on the outside of the test booklet the examiner should speak as follows:

"This test is to find out how carefully and how rapidly you can think about the relations of words and of the things for which these words stand. Now look at your papers and read silently the directions, while I read them aloud.

"When you are told to open your booklets, you will find on the inside thirty lines of words—three words and a blank space being printed on each line. In each of these lines, the first two words are related to each other in a certain way which you are to study out. You are then to write, in the blank space at the end, a fourth word which has the same relation to the third word as the second word has to the first.

"Look, for example, at the first sample, in which the second word is the plural of the first. Boxes means more than one Box, so the fourth word should be Cats, meaning more than one Cat.

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Write a fourth word which fits the third in the same way the second word fits the first.

1st Sample:	BOX . .	Boxes . .	CAT . . ..
2nd Sample:	DOWN .	Up . .	IN . . . .
3rd Sample:	EYES . .	See . .	EARS . . ..

"In the second sample, the fourth word should be Out, because Up is the opposite of Down, and Out is the opposite of In.

"In the third sample, the fourth word should be Hear, for See tells what Eyes are used for, and Hear tells for what Ears are used.

"You will have three minutes in which to write the fourth word in the thirty lines on the next pages. Work as rapidly as you can without making mistakes. Be sure to stop as soon as I call 'Time up.' Now turn your papers and begin."

Allow exactly three minutes (180 seconds) after saying "Begin," and then say "Stop! Time up! Turn your papers over." All papers should be collected at once to avoid corrections with resulting unfairness.

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Write a fourth word which fits the third in the same way the second word fits the first.

	FIRST	SECOND	THIRD	FOURTH	
1.	CAR	Cars	DOG	dog	1
2.	FRONT	Back	NEAR	[illegible]	2
3.	HAT	Head	SHOE	[illegible]	3
4.	BOY	Boy's	CAT	[illegible]	4
5.	ICE	Cold	FIRE	[illegible]	5
6.	BIRD	Flies	FISH	[illegible]	6
7.	MEN'S	Man	HENS'	[illegible]	7
8.	BREAD	Eat	WATER	[illegible]	8
9.	ACTOR	Theater	TEACHER	[illegible]	9
10.	HE	Him	SHE	[illegible]	10
11.	PRIEST	Religion	ATTORNEY	[illegible]	11
12.	CAT	Kitten	HORSE	[illegible]	12
13.	DO	Did	BUY	[illegible]	13
14.	SCULPTOR	Statue	PAINTER	[illegible]	14
15.	BOY	Man	LAMB	[illegible]	15
16.	TOP	Bottom	CEILING	[illegible]	16
17.	WATER	Fish	AIR	[illegible]	17
18.	TRAIN	Engineer	AUTOMOBILE	[illegible]	18
19.	STAND	Stood	BE	[illegible]	19
20.	CATTLE	Herd	FISH	[illegible]	20
21.	WORK	Day	SLEEP	[illegible]	21
22.	THREW	Thrown	ROSE	[illegible]	22
23.	GOOSE	Gander	DUCK	[illegible]	23
24.	BANTAM	Fowl	MERINO	[illegible]	24
25.	GIRL	Girls'	WOMAN	[illegible]	25
26.	WRONG	Right	STEAL	[illegible]	26
27.	FOOT	Feet	AVIATRIX	[illegible]	27
28.	HOUSES	House	CRITERIA	[illegible]	28
29.	QUEEN	Queens'	JONES	[illegible]	29
30.	PESSIMIST	Optimist	EXOTERIC	[illegible]	30

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Scoring the Test.

The Analogies test is scored according to the number of lines in which the candidate has written the proper fourth word. With each package of test blanks a stencil is furnished by means of which any one may score the results very quickly. The stencil is to be placed along the page next to the written column of words, and where the written word on the page corresponds to the word or words printed on the stencil at that level the written word stands as correct. Where there is disagreement between the written word and the words printed at that level on the stencil, a diagonal line (/) should be drawn through the number at the end of the written word to indicate that an error has been made. Where no word has been written on the blank, the number at the end of the blank may be circled to indicate the omission.

The final score should be written in the lower right-hand corner of the front cover of the test booklet. This final score is found by adding all the correct responses (the numbers not crossed out or circled). Since there are thirty lines, the maximum score possible is 30.

Scores from	0	to	5	indicate	Inferior Ability
" "	6	"	12	"	Low Average Ability
" "	13	"	23	"	Average Ability
" "	24	"	26	"	High Average Ability
" "	27	"	30	"	Superior Ability

About 30 per cent. of a group of college graduates should be expected to secure Superior ratings, about 50 per cent. High Average, and the remainder only Average ratings.

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MENTIMETER No. 25
HANDWRITING

Character of the Test.

Many pseudo-scientists have claimed the ability to interpret character and intelligence, and the past and the future, by means of an individual's handwriting. The present test has no relation to such misguided efforts. This test is designed to measure accurately the speed at which one can write, and to indicate the general quality of the product produced at that speed.

Large groups of individuals may be examined at the same time by this test, although it may be used as a test of an individual if necessary. It is quite certain that an individual who works at such a task as that set by this test in the company of other people will succeed better than if he works at it alone. The results obtained when an individual is tested alone are not exactly comparable, therefore, to the results which would be attained if he were tested in a group.

The general quality of one's handwriting has very little relation to his general intellectual ability. Some of our most intelligent men write a hand which is hardly legible, and the authors have seen some beautiful handwriting produced by feeble-minded children. It is, nevertheless, worth while for many employers to have in their records of the qualifications of employees an exact record of the speed and quality of each employee's handwriting. This record may never be of any use, but, on the other hand, it may at some time be of very great value unexpectedly.

In the public schools, measurements of handwriting quality may be crudely done with the present Mentimeter or more accurately done with the scales of Thorndike, Ayres, or Starch. It seems probable that by the time children have attained the "Average" quality contained in the Mentimeter and are

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writing at "High Average" speed it would be worth while for the teacher to excuse them from further drill as long as they maintain that standard in their every-day work. It will hardly be found necessary in practical life outside the school to write a better quality than "Average" except in a very few specialized occupations.

Directions for Giving the Test.

Candidates should be supplied with pen and ink and seated at a convenient table or desk. The test leaflet should then be passed out and explanations given of how to fill out the blanks on the title page. When all of the identifying information has been entered on the title page, the examiner should direct as follows: "This test is intended to discover how rapidly and how well you can write with pen and ink. Turn your papers over and notice at the top of the page the two printed lines:

"Mary had a little lamb
Its fleece was white as snow.

"When you are told to begin you are to copy these two lines over and over again just as many times as you possibly can before I call 'Stop.' Try to use your very best handwriting every time you copy. I shall allow you two minutes in which to write. As soon as I say 'Stop,' I want you to hold your pen up so that I can see you have obeyed the command. Remember that when I say 'Write,' you are to copy the two lines over and over again as rapidly and as well as you can. Ready, Write." Exactly two minutes (120 seconds) after saying "Write" the examiner should call "Stop! Hold up your pens! Now lay them down on the table. Blot your paper and hand it to me." All papers should be collected at once to avoid unfair work.

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Directions for Scoring the Test.

Each handwriting leaflet is to receive two scores, one for quality of handwriting and one for speed. The score in speed should be obtained by counting the number of letters written and dividing the result by two, this will be simplified somewhat by remembering that the sentence, "Mary had a little lamb" contains 18 letters and that the sentence, "Its fleece was white as snow" contains 23 letters, which makes 41 letters for each time the two sentences are repeated. The score in speed thus obtained by taking half of the total number of letters written should be entered on the proper blank at the lower right-hand corner of the title page.

Speed score from			0	to	30	indicates Inferior Ability
"	"	"	31	"	50	" Low Average Ability
"	"	"	51	"	75	" Average Ability
"	"	"	76	"	90	" High Average Ability
"	"	"	91 and upward			indicates Superior Ability

The score in quality of handwriting is to be determined by comparing the candidate's handwriting with samples on the Mentimeter for Handwriting Quality:* a grade of "A," indicating superior quality, should be assigned if the candidate's handwriting is as smooth, beautiful and legible as the sample marked "A," or if the quality more nearly approaches the quality of sample "A" than the quality of sample "B." The sample should be given a rating as quality "C" if its general beauty and quality be nearer to the printed sample "C" than to printed samples "B" or "D." **Give to any sample that grade which indicates the printed quality that most nearly equals it in beauty, legibility, and general merit.**

In making a record of any candidate's performance in the handwriting test both quality and speed should be recorded.

*The samples in the Mentimeter are selected from the Thorndike list and have the following values on the Thorndike Scale E, "Inferior" equals 8.0; D, "Low Average" equals 10.5; C, "Average" equals 12.2; B, "High Average" equals 13.4; A, "Superior" equals 16.

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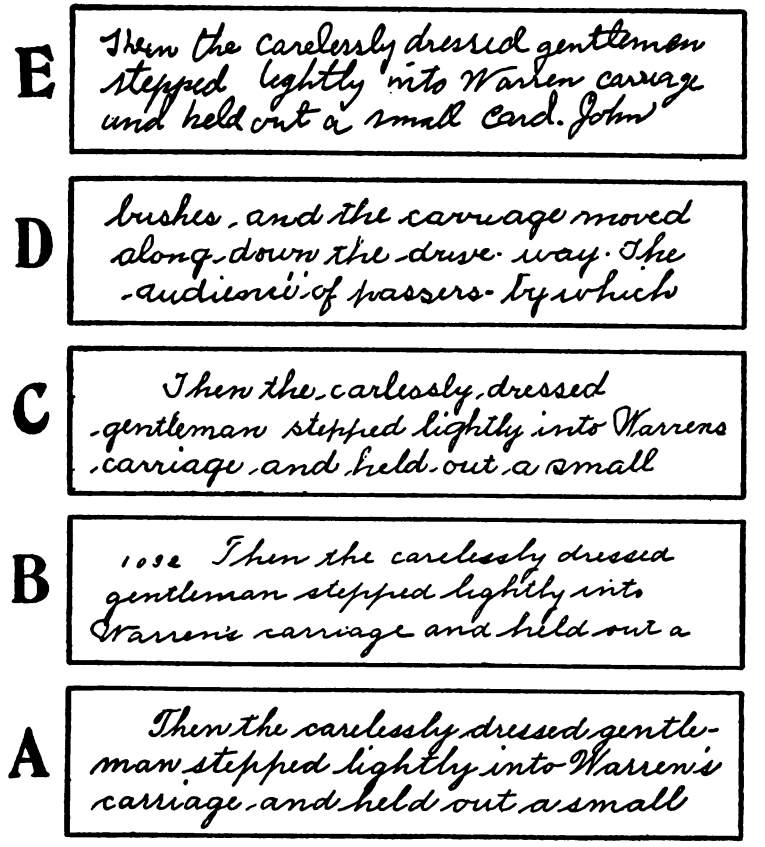
Mentimeter for Handwriting Quality


E
Then the carelessly dressed gentleman stepped lightly into Warren carriage and held out a small card. John
D
bushes, and the carriage moved along down the drive-way. The audience of passers-by which
C
Then the carlessly dressed gentleman stepped lightly into Warrens carriage and held out a small
B
1092 Then the carelessly dressed gentleman stepped lightly into Warrens carriage and held out a
A
Then the carelessly dressed gentleman stepped lightly into Warren's carriage and held out a small

"C-71" would mean that in the Mentimeter test this individual had written quality "C" at a speed of 71 letters per minute. The speed and quality together are necessary in order to know the entire truth about one's handwriting, for many people produce a beautiful handwriting by taking great pains and wasting much time.

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MENTIMETER No. 26

ENGLISH COMPOSITION

Character of the Test.

Only persons who have had the benefit of a fairly complete elementary school education will succeed very emphatically in this test of ability to write a composition in the English language. The test may be given to large numbers of people at the same time just as readily as to a single individual. The result of the test is, however, a very good index of the general intellectual capacity of the individual, unless he is handicapped by lack of familiarity with the language.

The most common use which most of us have for ability at composing in English is in writing letters to our friends or to those with whom our business brings us into contact. For this reason, the test consists in the statement of a condition under which any one of us might find ourselves and in asking the candidates to write an appropriate letter. The result is graded into one of five groups, according to its general quality.

The problem presented to the candidate is fairly complex. First of all, he must be able to understand the situation described by the examiner and to appreciate what type of letter would be most appropriate under these circumstances. He must also be able to write the words which would express his feelings in the described situation, and in order to make his feelings clearly understood he should be able to punctuate and organize his sentences effectively. The result is a useful index of the general efficiency and maturity of any candidate who has been taught to write in English.

In industrial life there are many types of positions for which persons whose ability to compose written English need not be better than "Inferior," although there are other positions which would require "High Average" quality of English composition. The advantage of the following Mentimeter lies in the possibility it gives of identifying more exactly just what

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quality is meant when one speaks of "High Average" composing ability.

In the public schools the Mentimeter will serve as a crude basis for classifying the general quality of the compositions written, but for highly scientific work it would be desirable to secure some form of the "Hillegas Scale" which is much more exact and well standardized. A very entertaining evening could be enjoyed by giving this test to a group of people gathered together for social purposes, especially with a group which had tired of the ordinary means of entertainment. Reading the products written should in such a case be entrusted to some one or two individuals of good reading ability and wise judgment. Frequently the results would contain very amusing paragraphs.

Directions for Giving the Test.

Each candidate should be comfortably seated and provided with writing material before any instructions are given. It will usually be well to furnish paper on which there are lines, as many people find the lack of ruling a distinct hindrance to the flow of their thoughts. When everyone is ready, the examiner should direct that each individual write his or her name, age, address, and any other information which seems desirable. The following directions should then be given:

"This test is planned to discover how well you can use the English language in expressing your thoughts and feelings. Imagine yourself employed in a large business house in the city. While you are waiting to find out whether or not you are going to be one of those fortunate people who will be granted a vacation, imagine that you receive a letter from a friend in the country asking you to spend your vacation on the farm. Since you do not know that you will have a vacation, it is impossible for you to accept the invitation at once, but it is necessary for you to acknowledge the fact that you have received the invitation. Write a letter to this friend in the country saying that the invitation has been received and that you appreciate it. You

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need not make the letter long, but write it just as well as you can." At least twenty minutes should be allowed for the writing of this letter. At the end of twenty minutes all papers should be collected, whether the letters are complete or not—enough will have been written to demonstrate the quality of letter each can write.

MENTIMETER FOR QUALITY OF ENGLISH COMPOSITIONS

Quality: Superior, A.

MY DEAR JEAN:—

Your letter made me peculiarly happy this morning. The joys of last Summer so wrapt themselves about me that, instead of hurrying down Broadway to business, I was sitting on the veranda with you and little Bobby at sunset watching the Hudson creep slowly in and out among the hills. One by one the little villages dropt out of sight as the fog came down from the Catskills, crept across the river, up through the woods and finally nestled among the neighbour's fir trees. Black crows cawed as they flew lazily over the house, and the little birds came up close to the edge of the woods to sleep in the barberry bushes. Bobby said they came up close so we would hear if anything got them. The little dear! Tell him I have saved a number of stories for him—two new ones about light-houses.

I am rather doubtful as to whether I will be granted a vacation this year. Business conditions are so far from normal, and we are very short of help. However, I may be lucky, and if I am nothing would make me so happy as to spend every day of it with you and little Bobby. I expect to know definitely by the end of next week concerning my vacation and shall write to you immediately.

I thank you more than I can say, Jean. Your invitation has made me very happy.

Sincerely,

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Quality: High Average, B.

MY DEAR MR. SMITH:

I appreciate your invitation expressing the desire to entertain me again at your farm during my Summer vacation. I should enjoy coming back this Summer, although I have occasionally been afraid that I was something of a hindrance to your work. It is such a change for me to get to the country that I shall certainly come if possible.

I shall let you know just as soon as I find out whether or not I am to have a vacation this Summer. Thanking you for your kind invitation, I remain,

Sincerely yours,

Quality: Average, C.

MY DEAR FRIEND:

Your letter of June 10th has been received, and in reply I would say that I am not sure that I will get my vacation this summer. The boss hasn't said anything about vacations yet. I would like to come just as much as you would like to have me, but I can't promise until the old man lets us know. I'll write to you just as soon as I learn what to expect. Thanks for your invitation.

Yours,

Quality: Low Average, D.

DEAR FRIEND

I got your letter alright, but it don't look like I was going to get any vacation this summer. We have all been tryin to hint to the boss about how tired we all was but he has to be knocked down to take a hint I guess.

I sure do hope he lets me off. You know how I'd like to come and I want you to keep plenty of green truck growin in the gardin for me to eat.

Yours truly

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Quality: Inferior, E.

DER FREND
id lik to cum out to yer farm ef the flise ant tou bad but i got to wate the boss hant told us we can tak ar vakashins yit hous the frut & burys this yere il cum ef i can

Directions for Scoring the Test.

Each composition should be compared with the five contained on the Mentimeter for English Composition quality. Give the written composition a mark as "Average," "Superior," or "Low Average" according to its quality. If a composition seems to be better than the one on the Mentimeter which is called "Average" but poorer than the one called "High Average," try to decide which it is nearer in general quality. "Average," therefore, will mean that a composition is nearer in its quality to the sample printed as "Average" than it is to the sample printed as "High Average," or to the sample printed as "Low Average." Any composition which is distinctly better than "Superior" should be rated as "Superior," and any composition which seems poorer than the one printed as "Inferior" should be rated as "Inferior."

MENTIMETER NO. 27

POETIC DISCRIMINATION TEST

Character of the Test.

Differences in the intellectual abilities of people manifest themselves in three fairly distinct ways: first, in ability to accomplish results; second, in ability to think clearly about the situations in which they find themselves; and third, in the feelings which these situations arouse. Practically all of the tests now available for measuring educational achievements or intellectual ability are concerned primarily with the ability to *do* or to *think* about situations. This member of the Mentimeter family

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is concerned chiefly with the way in which one *feels* about different types and qualities of poetic expression. The test cannot be given to illiterate or foreign-language speaking persons. It is planned as a group test of persons who read and understand English readily.

The test consists of six short stanzas selected from recognized English poets.* Two false versions of each stanza have been prepared and appear on the same page with the original. The group being examined are asked to read each version, trying to think how it would sound if read aloud, and to choose the one which they like "best" and the one which they consider the "poorest" poetry. The differences between the false versions and the true in the first set are smaller than the differences found in the succeeding ones. The score obtained by any individual therefore depends upon how small a difference he can notice.

Although this test is very interesting and entertaining its reliability is not determined and its usefulness is as yet questionable. It certainly would have no great value in industrial life and only small importance in public school work; its chief service will be entertainment in the home and at social gatherings. It is surprising how poor the judgment of many people is regarding the quality of poetic products. It would be interesting at social affairs at which this test is used to make a tabulation of just how many of those present have selected each different version.

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*The Best Version in each set is selected from the writings of recognised poets:

Set I	William Wordsworth in "She Dwelt Among."
Set II	Agnes Millay in "My Tavern."
Set III	Percy Bysshe Shelley in "To——"
Set IV	Algernon Charles Swinburne in "Étude Réaliste."
Set V	Edward Coote Pinkney in "Health."
Set VI	James Thompson in "Sunday Up the River."

Mr. Earl Hudelson contributed the Middle and Poorest Versions for Set II. One of the present authors is responsible for the mutilated forms of the other selections. A much more scientific and accurate instrument for measuring poetic discrimination is being developed by Prof. Allan Abbott and one of the present authors.

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Directions for Giving the Test.

The examiner should distribute the examination booklets and writing materials with the following instruction:

"Do not open this booklet until I tell you to do so. Notice on the title page a number of blanks for your name, your age, and the like. Fill out these blanks at once but do not look inside the booklet."

As soon as the blanks on the title page have been filled the examiner should ask the candidates to read carefully the directions while he reads them aloud.

"When you open your book you will find six different sets of poetic stanzas. Each set appears in three different versions. You are to read each version carefully, trying to think how it would sound if read aloud, and then to record on the blank space provided for it which version you think is 'best,' which version you think is 'poorest' and which version you think is of 'middle' value. If you decide that version Y is best then write 'Y' after the word Best. If Z is the worst, then write 'Z' after the word Poorest, and 'X' after the word Middle.

"Think carefully about each set and choose the one which you really think is the best poetry. You will be allowed fifteen minutes in which to read and decide about the six sets. Begin with set No. 1 and take them in order. Ready! Open your papers and begin work."

Exactly fifteen minutes after saying "Begin" the examiner should call, "Stop! The time is up. Let me have your papers." All papers should be taken up at once.

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SET I

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

Best ....Z.....
Middle ....Y.....
Poorest ....X.....

Version X

Once there was a violet,
  Growing near a stone;
It reminded me of a star
  All alone in the sky.

Version Y

A violet grew by a mossy stone,
  Where it was hard to see;
It looked like a star, for it shone
  As pretty as could be.

Version Z

A violet by a mossy stone
  Half hidden from the eye!
—Fair as a star, when only one
  Is shining in the sky.

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SET II

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

I'll keep a little tavern
  Below the high hill's crest,
Wherein all gray-eyed people
  May set them down and rest.

Best ....X.....
Middle ..Z.....
Poorest ..Y.....

Version X

There shall be plates a-plenty,
  And mugs to melt the chill
Of all the gray-eyed people
  Who happen up the hill.
Ay, 'tis a curious fancy—
  But all the good I know
Was taught me out of two gray eyes
  A long time ago.

Version Y

There shall be dishes a-plenty,
  And something to take off the chill
Of as many gray-eyed people
  As are willing to climb the hill.
'Tis truly an odd fancy,
  But everything good that I know
I learned out of two gray eyes
  Many years ago.

Version Z

And when those gray-eyed people
  Have entered in the gate,
We'll pass the cheering mug around,
  And also pass the plate.
It may sound rather funny,
  But I was helped a lot
By someone who had gray eyes
  When I was a little tot.

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SET III

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

Best ... Z .....
Middle ... Y .....
Poorest ... X .....

Version X

Music, when faint voices cease,
  Continues in the memory—
Odours, when the violets fade,
  Linger where their smell was made.

Version Y

Music lives in the memory,
  Though the songster's voice is done.
Sweet odours haunt the nose,
  Though the violets that waked them are gone.

Version Z

Music, when soft voices die,
  Vibrates in the memory—
Odours, when sweet violets sicken,
  Live within the sense they quicken.

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SET IV

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

Best ...Y.....
Middle ..X.....
Poorest ..Z.....

Version X

No rosebud yet has e'er been seen,
  Or flower in tropic lands,
To equal these, more beauteous e'en—
  A baby's hands.

Version Y

No rosebuds yet by dawn impearled
  Match, even in loveliest lands,
The sweetest flowers in all the world—
  A baby's hands.

Version Z

No flower that grows,
  In this or any other lands,
Compares with these, of daintiest rose—
  A baby's hands.

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SET V

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

Best ..... Y X
Middle ..... Z 2
Poorest ..... X 1

Version X

She speaks in tones of silver
With the voice of morning birds,
And every word that's spoken of her
Echoes the music of her words.

Version Y

Her every tone is music's own,
Like those of morning birds,
And something more than melody
Dwells ever in her words.

Version Z

Her tones are pure as silver chimes,
Her notes of birdlike beauty;
The words she speaks are at all times
Replete with life and beauty.

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SET VI

Read each version carefully and try to think how it would sound if it were read aloud.

Which version is the poorest poetry, and which is the best poetry?

Best ..Y.....
Middle..X.....
Poorest..Z.....

Version

A pipe and a book,
  By the side of the brook,
With the world and her troubles forgot;
  Just to read and to smoke,
Man forgets that he's broke,—
  And he finds, after all, that he's not.

Version Y

Give a man a pipe he can smoke,
  Give a man a book he can read;
And his home is bright with a calm delight,
  Though the room be poor indeed.

Version Z

Let a man smoke,
  And let a man read;
A pipe and a book in any old nook,
  Lend peace which is wealth indeed.

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Directions for Scoring the Test.

The score in this test is determined in a somewhat more complicated manner than is the case of any other of the Mentimeter series. Two points are allowed each candidate for selecting as "Best" the original version in any set and one point of credit is allowed for selecting the poorest version as "Poorest." It will be observed that the maximum score on any set will be three points if the candidate arranges the versions in the correct order, two points for selecting the best and one point for selecting the worst. This makes the total maximum score, for six sets, eighteen points.

The correct order of merit for each set of selections has been determined by the judgment of approximately one hundred competent judges. It is as follows:

SET	I	II	III	IV	V	VI
Best	Z	X	Z	Y	Y	Y
Middle	Y	Y	X	X	Z	Z
Poorest	X	Z	Y	Z	X	X

Write the final score obtained on the total of the six sets in the lower right-hand corner of the title page of the examination booklet.

Scores	0 to	3	indicate	Very Inferior Ability
"	4 "	7	"	Inferior Ability
"	8 "	11	"	Average Ability
"	12 "	14	"	Superior Ability
"	15 "	18	"	Very Superior Ability

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MENTIMETER No. 28
ARITHMETIC REASONING

Character of the Test.

Teachers in schools have for a long while based a large part of their judgment about any individual's intellectual ability almost exclusively upon the facility with which he solved arithmetic problems. Although the ability to solve arithmetic problems has not been so frequently recognized by investigators as an index of intellectual ability as has ability in English, the teachers have found it much easier to estimate intellectual ability upon the basis of showing in arithmetic, because it is easier to judge of success in arithmetic than to judge of success in English or other fields. A child can either solve the problem or else he cannot. This objective nature of the subject of arithmetic has made it a very important subject for the teacher in deciding upon promotions.

In practical life, arithmetic has been recognized as being of value because the training in arithmetic was supposed to enable a student to keep other people from cheating him in financial transactions. The writers have known employers, on a small scale, who used certain tricky arithmetic problems as the basis upon which to judge the intellectual ability of prospective employees. Arithmetic problems have had and will continue to have a distinctive place in the measurement of intellectual capacity. It is probable that this place is well deserved.

Directions for Giving the Test.

As soon as the candidates are seated, they should be supplied with pencils, and the examination leaflet should be distributed with the instruction that it is not to be turned over until special instructions are given to that effect. In order to keep the candidates busy, the examiner should ask them to fill out the

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blanks on the title page, giving name, age, etc. When this information has been obtained, the examiner should ask the candidates to read the directions silently while he reads them aloud.

"On the other side of your papers you will find fourteen problems in arithmetic. The first problems are simple and easy and the last ones are more difficult. Begin with the first problem and solve as many as you can in the four minutes after I say 'Go!' Write your answer at the right-hand side of the questions on the dotted lines provided for the answers. You may figure on the left-hand side or on the back of the blank, if you wish. Solve as many problems as you can but be sure to get the answer right. Ready! Go!"

Allowing exactly four minutes after saying the world "Go!" the examiner should call "Stop! Turn your papers over. Give them to me." All papers should be collected immediately.

Write the answers to these problems on the blanks
Use the other side of the sheet to figure on

ANSWERS

1. How many are 5 men and 3 men? ..... 8 ...
2. If you earn 2 dollars each day, how much do you earn in 6 days? .... 12 ....
3. If you have 10 nickels and lose 3 of them, how many would you have after you found 2 of those that were lost? ..... 9 ....
4. How many benches will be needed in order to seat 20 people at a picnic, if 4 people sit on each bench? 5 .....
5. If James sold 3 Sunday papers for 5 cents each and then bought an apple for 3 cents and an orange for 4 cents, how much money had he left? (over) ..... 1 .....

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ANSWERS

6. How much change should you get from a dollar bill after buying 39 cents' worth of potatoes, 12 cents' worth of celery, and 26 cents' worth of butter? ..23.....

7. If the price of lemons is 2 for 5 cents, how many can you buy for 40 cents? ...16.....

8. If 29 merchants each bought 34 quarts of canned peas at a wholesale house which had previously sold 2,387 quarts of the same brand, what was the total number of quarts of this brand sold? 3373

9. If a wholesale merchant sold for $50 sugar which he had purchased for $45 and thereby gained 1 cent per pound, how many pounds of sugar were there? 500

10. If four and a half pounds of fancy onions cost 27 cents, how much will eight and a half pounds cost? ...51.....

11. Half of the people in a certain city block were born of American parents, one eighth have American fathers and foreign-born mothers, one eighth have American mothers and foreign-born fathers, and both parents of the rest are foreign-born. Of the 1,200 people living in this block, how many have American fathers? 1250

12. A factory used 1,288 tons of coal in 23 days. During the first ten days after a new addition to the factory was opened, the average daily coal consumption was 78 tons. How many more tons were burned per day than previously? ....22...

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ANSWERS

13. A man spent for cigars and tobacco one sixteenth of his wages for one day. He spent five times as much for food, and half of what remained for repairs on his watch, which left him a dollar and a half. How much did he receive per day? $3

14. At the middle of the month a merchant had $1,200 in the bank. He deposited $30 each day for six days and on Monday morning wrote checks for two thirds as much as his deposits for the week. Tuesday afternoon he deposited a check one fourth as large as his balance in the bank. What was his balance on Tuesday night? .....

Directions for Scoring the Test

The score in this test is the number of problems with absolutely correct answers. No credit should be given for partially correct answers. The total score of the test should be entered on the blank at the lower right-hand corner of the title page.

Scores	from	0 to 3	indicate	Inferior Ability
"	"	4 " 7	"	Low Average Ability
"	"	8 " 10	"	Average Ability
"	of	11 and 12	"	High Average Ability
"	"	13 and 14	"	Superior Ability

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Mentimeter No. 29

PRACTICAL JUDGMENT TEST

Character of the Test.

This test is applicable to all persons who can read English as readily as the average third-grade public school pupil. For persons of less ability to read but of good ability to understand English, the questions may be asked orally in an individual examination. The results obtained when the questions are asked orally should not be compared with the results obtained when the printed test booklets are employed in a group examination. It is very strongly recommended that the test be used primarily as a group test, according to the instructions given here, in order that direct comparisons may be readily made between the results obtained in various places by different examiners.

The present form of the test is a lengthening of the form used in the Army Alpha series. Twenty-four elements are contained in the Mentimeter form, while only sixteen elements were used in the Army form. Another advantage of the present form over the military edition is the more definite attempt at arrangement of the elements in the test according to their difficulty. Having the series graduated in difficulty, from easy to hard, is a distinct advantage, particularly with young or dull persons, who quickly stop trying unless their first efforts are successful.

The use of questions, in the answering of which thoughtful judgment about every-day affairs would be required, has always been a favourite method of discovering the degree of intelligence possessed by a child or by an adult. Binet, the French psychologist who developed the mental-age scale for testing feeble-minded subjects, included in his series a number of test questions of this type. The Stanford Revision of the Binet tests includes three such questions in the Eight-Year-Old series, and three other more difficult questions in the Ten-Year-Old list.

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The chief modification of the method in adapting it for group testing was the supplying of three or four answers from which the subject should select the correct reply. This change makes the markings of the results quite simple, but it takes from the test itself some of its virtue as a measure of the richness of ideas possessed by the person tested. Instead of having to think out an appropriate answer, one needs only to read the answers printed and to use good judgment in selecting the one to be checked as "best."

The Mentimeter form of the test, although superior in its length and arrangement to the military version, is nevertheless not yet ideal as an intelligence test. The simplest questions and answers that can be printed are too difficult for first- and second-grade school pupils to read and understand, while the most difficult questions and answers one could devise would not be general enough in their subject matter to be included in a "general intelligence" test. In other words, the range of ability that this test will measure is not so wide as that measured by some other Mentimeter tests, with the result that the speed of reading and of making judgments plays a larger part in determining the final score than it would in a perfect intelligence test. In spite of the large part played by speed, the test is a useful index of *ability to learn* in certain lines of work where rapid decisions on practical problems are necessary.

It is probable that the Practical Judgment test will be found more useful in the measurement of intelligence among school children and clerical workers than in the classification of general employees, although the reader may find unexpected relationships between this test and certain routine occupations. Reliance should be placed upon it only after it has demonstrated in actual trials that it has a close relationship to the special ability desired.

Its use in social gatherings as a form of entertainment will be greatest where each person marks the papers of some other member of the group and reports the judgments found incorrect.

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Most persons are surprised, when they come to look over their booklets carefully, to find how many foolish errors have crept into their records while working at high speed. In order to increase the number of imperfect records and thereby add somewhat to the amusement of the group, the examiner may announce and use two minutes as the time limit, and urge everyone to try to work all of the 24 questions in that time. The general confusion will be increased if the examiner signals the end of the first minute and the end of a minute and a half. Under such conditions, of course, no serious use can be made of the results obtained. The score on the test is not to be used seriously except where the instructions and procedure are exactly as specified below.

Directions for Giving the Test.

Candidates should be comfortably seated at a table or supplied with a convenient writing board. A well-sharpened pencil (or pen with ink) should be in the hands of each candidate before any blanks are passed out. The test booklets should then be distributed, the announcement being clearly made beforehand that "no one will be allowed to open the booklet or turn it over until the signal is given to do so."

When each candidate has been supplied with a test booklet, title page up, the examiner should say: "Now, write your name on the blank following the word Name." After a pause long enough to allow this direction to be carried out, the examiner should continue with a similar instruction for each of the other pieces of information required by the title page blanks. "Age at last birthday" should be insisted upon, if there is any question of reporting age in any other way. Group numbers and locations may be left blank where only small numbers of persons are being tested and where there is no probability of getting the papers from one place mixed with those from some other place. The name of the school, factory, or city will usually be sufficient for the blank headed "Location."

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After the necessary identifying information has been entered at the top of the title page, the examiner should ask the candidates to read silently the directions while he reads them aloud. He should then read slowly and distinctly:

"The following pages contain 24 questions and 4 answers to each question. You are to vote for the best answer to each question by making a check mark (✓) in the square that stands before it. The questions are not hard, and you will be allowed 3 minutes to check the best answers, but be sure to work carefully and rapidly. Vote only for the one best answer to each question. Turn the page! Go!"

At the end of exactly 3 minutes after saying "Go!" the examiner should call "Stop! Close your booklets and pass them to me." All papers should be collected at once in order to avoid unfairness and cheating.

MARK (✓) THE SQUARE IN FRONT OF THE BEST ANSWER TO EACH QUESTION

1. What should one do when he is thirsty?

- ☐ Cry until someone gives him a drink.
- ☐ Eat a piece of salt pork.
- ☑ Get a drink of water.
- ☐ Read a Coca Cola advertisement.

2. Why do children like to eat candy?

- ☐ It makes them fat.
- ☑ It tastes good.
- ☐ It is good for them.
- ☐ It is a cheap food.

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3. What should one do if it is raining when he starts to work?

- ☐ Put on lighter clothing.
- ☑ Wear a raincoat.
- ☐ Call up the office.
- ☐ Stay at home all day.

4. What is the thing to do when your house catches fire?

- ☐ Try to find out how it started.
- ☑ Ring the alarm and try to put out the fire.
- ☐ Run in the other direction.
- ☐ Watch it burn and calculate your insurance.

5. What should one do if he accidently steps on someone else's toes?

- ☐ Call for help.
- ☐ Run for the doctor.
- ☑ Ask the person's pardon.
- ☐ Take his own part.

6. Why do the leaves fall off the trees in the autumn?

- ☑ The frost has killed them.
- ☐ To protect the flowers from freezing.
- ☐ To enrich the ground.
- ☐ So that one can see farther.

7. Why do people wear heavier clothing in January than in June?

- ☑ To protect them from the colder weather.
- ☐ Because it looks better with furs.
- ☐ Everybody else does it, especially in January.
- ☐ It makes a good impression on other people.

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8. Where might one expect to find the largest number of expert swimmers?

- ☐ At the circus.
- ☑ At the beach of a summer resort.
- ☐ At a Sunday School picnic.
- ☐ At a moving picture show.

9. What should a person do when he is late getting started to work in the morning?

- ☐ Wait until the next day.
- ☐ Think up some excuse to make.
- ☑ Try to make time by hurrying.
- ☐ Blame it on the street cars.

10. Why do school houses usually have flag-poles?

- ☐ For the boys to exercise on.
- ☐ To show where to have a flag drill.
- ☑ To display the flag and inspire patriotism.
- ☐ To decorate the school yard.

11. Why does water freeze in winter?

- ☐ It is warm in summer and we need ice.
- ☐ So the children can skate.
- ☑ Water always becomes solid at low temperatures.
- ☐ So it can be put in refrigerators.

12. What is the best way to stop up a hole by which mice enter the kitchen?

- ☐ Stuff it with paper.
- ☐ Place a pile of rags in front of it.
- ☐ Put a corn cob in it.
- ☑ Nail a piece of tin over it.

(over)

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13. Why is milk a good thing to feed young children?

- ☐ It comes from cows that eat fresh grass.
- ☑ It is an easily digested and wholesome food.
- ☐ It is so pure and white to look at.
- ☐ It can be bought in pint or quart bottles.

14. What kind of light is best for a reading table?

- ☐ A tallow candle.
- ☐ A mercury vapour lamp.
- ☐ A coal oil lantern.
- ☑ An incandescent electric bulb.

15. What is the purpose of advertising food products?

- ☐ To make people hungry.
- ☐ To decorate street cars and magazines.
- ☐ To make people think about eating.
- ☑ To create a demand for special brands.

16. Why is harness put on horses?

- ☑ So that their strength may be utilized.
- ☐ So that their beauty will be recognized.
- ☐ To match the colour of the carriage.
- ☐ To keep them warm.

17. Why do people put food in refrigerators?

- ☐ To get it out of the way.
- ☑ The low temperature keeps it fresh.
- ☐ To help ice men make a living.
- ☐ Because the law requires it.

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18. Why are fire escapes more frequently put on tall buildings than on one-story buildings?

- ☐ A tall building is more likely to burn down.
- ☐ They would spoil the looks of a low building.
- ☐ Low buildings have fire extinguishers.
- ☑ One could jump from one-story buildings.

19. What should one do with a baby when it cries?

- ☑ Discover and remove the cause of its crying.
- ☐ Spank it and put it to bed.
- ☐ Get it a drink of water and rock its cradle.
- ☐ Give it a bottle of milk or sing to it.

20. Why is country air considered more healthful than city air?

- ☑ It has fewer impurities in it.
- ☐ Trees and grass grow in the country.
- ☐ More people die in the city.
- ☐ The wind is stronger in the country.

21. Why do railroads use electric engines in some cities?

- ☐ They run faster than steam engines.
- ☐ They look better than steam engines.
- ☑ To avoid making the city smoky.
- ☐ In order to make less noise.

22. What is the main purpose of lightning rods?

- ☐ To decorate the roof of the house.
- ☐ To make the lightning strike somewhere else.
- ☐ To show which way the wind blows.
- ☑ To remove the electricity from the air.

(over)

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23. What is the safest altitude and speed for flying in an airplane?

- ☐ Low and slowly.
- ☐ Low and rapidly.
- ☑ High and rapidly.
- ☐ High and slowly.

24. What is the chief purpose of newspaper headlines?

- ☐ To make the paper attractive.
- ☐ To show what actually happened.
- ☑ To help one decide where to read.
- ☐ To guide public opinion wisely.

Directions for Scoring the Test.

The score in this test is the number of questions correctly answered. A stencil is furnished with each package of tests, which makes it possible to check up at a very rapid rate the accuracy of the votes cast, without ever reading a single word of the answers. The stencil is merely to be adjusted to the page, according to directions given on its face, and where the check mark made by the candidate corresponds to the printed mark on the stencil the question has been correctly answered, while if there is not agreement between stencil and candidate's check no credit is to be allowed on the question. Any fairly careful clerical worker can learn in two minutes to score such a test with a stencil as rapidly and accurately as a thoroughly trained psychologist could do it.

The final score should be entered in the lower right-hand corner of the front or title page, where it will be easily associated with the name and other information about the candidate.

Scores from	0	to	3	indicate	Inferior Ability
" "	4	"	8	"	Low Average Ability
" "	9	"	14	"	Average Ability
" "	15	"	19	"	High Average Ability
" "	19	"	24	"	Low Superior Ability

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MENTIMETER NO. 30
LOGICAL-CONCLUSIONS TEST

Character of the Test.

This test is to be given to large groups of individuals at the same time, although it may be given as a part of an individual examination. It will not be found worth while to give this test to individuals who have not had at least the equivalent of an elementary school education. The solution of the problems contained is so difficult that not more than half of the pupils of the sixth or seventh grade of the elementary school would be able to answer correctly more than five or six of the problems.

The method of the test is to present a short hypothesis, introduced by the word "if" and followed by four different conclusions introduced by the word "then." The individual being examined should read carefully the first part of the statement and understand exactly what it means, and should then put a check mark before the conclusion which would logically follow the hypothesis. There are twelve of these problems, beginning with one which is quite simple and elementary, and progressing to more difficult and more complex statements of a similar nature. The explanations by which this test is introduced are illustrated by an example and are not difficult to understand. The difficulty of the test lies in keeping clearly in mind just what are the implications of the introductory statement or hypothesis.

The present test is almost entirely new, both in its form and in its content. The nearest approach to this particular test was made by Dr. Agnes L. Rogers at the suggestion of Professor Thorndike, when she prepared a list of six problems of which the following is a good sample: "P is larger than Q, R is smaller than Q, therefore P is.....R." The blank is to be filled in. It will be observed that the present Mentimeter differs from Doctor Rogers's test in that names of familiar persons or objects are used in place of the capital letters and that four

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conclusions are stated from which the subject is to select the proper one, rather than leaving to the subject the formulation of his own conclusion.

Because of its newness, it will be impossible to state here just what is measured by this test, but certainly the ability to read and understand the words is one factor, and the ability to think clearly about the logical implications of these words is another very important element making for success. The ability to see the relations between the words is probably as near to what may be called "logical ability" or "reasoning" as to any other popularly recognized "mental qualification." Although Doctor Rogers found a coefficient of correlation of .65 between her form of the logical reasoning test and a composite measure of mathematical ability, the present Mentimeter is so different that its true value can only be indicated by the comparisons which its users will be able to make between their results and the most accurate measures obtainable of special ability.

This test will probably have very little usefulness in commercial or industrial fields, although it may be very helpful for a professional group such as lawyers, educators, etc., in the selection of clerical or professional assistants. In the public schools, it is quite certain that it should not be used below the high school grades. Even in the high school, it is probable that only those with very great ability in handling abstract ideas and symbols of ideas will be able to make a high score.

The subject matter of those statements which appear in the test is such as would not be found in ordinary life and has very little value in itself. As an entertainment feature, this test will not be successful except among a very specially selected group of people who believe themselves to be extraordinarily keen intellectually. It might be held in reserve as a special "stunt" for any persons who seem to think that they have demonstrated their "high-brow" qualities by making high scores in other tests. Shortening the time limit from five minutes to three minutes would further add to the consternation of such persons.

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Directions for Giving the Test.

The examiner should distribute one test booklet to each candidate, announcing at the beginning of the distribution that the booklets should not be opened or turned over until an order to that effect is given. Since the blanks on the front cover of the booklet will be self-explanatory to any person capable of taking the test, the examiner may direct that each candidate fill out the blanks on the title page of his booklet as soon as he receives it.

When the information blanks have been filled satisfactorily the examiner should ask the candidates to read the directions silently while he reads them aloud. This reading should be at a very deliberate rate and in good, clear tones:

"The following pages contain twelve sentences, each sentence being printed with four different endings. Only one of these endings can be true if the first part of the sentence is true. You are to decide which ending or conclusion is truest or agrees best with the first part, and to make a mark in the square standing in front of that best ending. Notice the example:

"If roses cost more than violets, then violets

- ☐ cost more than roses
- ☐ cost as much as roses
- ☑ do not cost as much as roses
- ☐ do not cost less than roses

"The only one of the four endings which can be true, if the first part of the sentence is true, is the third, 'violets do not cost as much as roses,' so the square in front of this third conclusion should be check-marked.

"You will have five minutes in which to read and mark the twelve sentences. Think carefully and get all of your marks correctly placed. Ready! Go!"

At the end of five minutes exactly, call "Stop! Time up! Give me your papers." All papers should be collected at once.

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MARK (✓) THE SQUARE IN FRONT OF THE TRUEST ENDING TO EACH SENTENCE

1. If John is older than James, then John is

- [ ] younger than James
- [ ] older than James
- [ ] not as old as James
- [ ] not older than James

2. If Mary is younger than Will, then Will is

- [ ] younger than Mary
- [ ] not older than Mary
- [ ] not as old as Mary
- [ ] older than Mary

3. If Dot is taller than Pet, then Pet is

- [ ] as tall as Dot
- [ ] shorter than Dot
- [ ] not shorter than Dot
- [ ] taller than Dot

4. If May is heavier than Jean, then Jean is

- [ ] not lighter than May
- [ ] as heavy as May
- [ ] not heavier than May
- [ ] heavier than May

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5. If Walter runs faster than William, and William runs faster than David, then David runs

- [ ] faster than Walter
- [ ] as fast as William
- [ ] as fast as Walter
- [ ] slower than William

6. If Edna is smarter than Bertha, and Bertha is not as smart as Mabel, then Mabel is

- [ ] not as smart as Edna
- [ ] not as smart as Bertha
- [ ] smarter than Edna
- [ ] smarter than Bertha

7. If Mr. Jones is wealthier than Mr. Smith, and Mr. Smith is poorer than Mr. Brown, then Mr. Smith is

- [ ] not as poor as Mr. Jones
- [ ] richer than Mr. Jones
- [ ] not as rich as Mr. Jones
- [ ] not poorer than Mr. Jones

8. If Robert is noisier than Harold and Harold is as noisy as George, then George is

- [ ] not noisier than Robert
- [ ] noisier than Robert
- [ ] noisier than Harold
- [ ] not as quiet as Robert

(over)

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9. If Henry drives faster than Joseph, and Joseph drives no more slowly than Peter, and Peter drives more rapidly than Edgar, then Edgar drives

- [ ] as rapidly as Henry
- [ ] no more slowly than Joseph
- [ ] as swiftly as Peter
- [ ] less rapidly than Henry

10. If Monday was cooler than Wednesday, and Tuesday was cooler than Monday, and Thursday was hotter than Wednesday, then Monday was

- [ ] not hotter than Tuesday
- [ ] not cooler than Thursday
- [ ] not warmer than Thursday
- [ ] cooler than Tuesday

11. If Mrs. Brown is exactly as extravagant as Mrs. Smith, and Mrs. Smith is less extravagant than Mrs. Jones, then Mrs. Jones is

- [ ] more frugal than Mrs. Brown
- [ ] not as frugal as Mrs. Brown
- [ ] less extravagant than Mrs. Smith
- [ ] not more extravagant than Mrs. Smith

12. If there were four parades in a month, and the first was larger than the fourth, and the third was smaller than the second, and the second was not smaller than the first, then the fourth was

- [ ] larger than the second
- [ ] equal to the second
- [ ] not smaller than the second
- [ ] not larger than the second

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Directions for Scoring the Test.

The score in this test is the number of sentences for which the correct conclusion is checked. The stencil furnished with the test booklets makes this process of counting the number correct so simple that a child can do it almost at a glance. The degree of intellectual capacity is indicated roughly by the score as follows.:

Scores	0 to	1	indicate	Low Average or Inferior Ability
"	2 "	5	"	Average Ability
"	6 "	8	"	High Average Ability
"	9 "	12	"	Superior Ability

Attention should be invited here again to the fact that this is a new test and that its reliability and implications will need to be carefully tested and measured before one can be sure what it measures or how accurate it is.

2 7 1

1 7 4

3 6 2

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CHAPTER XI

TRADE TESTS OR TESTS OF SKILL

WHILE the determination of individual skill in the performance of a given operation is not, strictly speaking, a test of intelligence or of mental capacity, it has been established that the most accurate and speedy method of discovering the precise degree of skill possessed by any artisan is closely analogous to the scientific method of mental measurement. It has been found, moreover, that there is quite a close relation between an individual workman's skill at his trade and the degree of mental capacity disclosed by the Mentimeter or similar scientific tests; the more intelligent the worker, the greater his skill if he has any natural aptitude for his trade.

Many persons view with skepticism the idea that a workman's degree of skill at his trade can be determined by tests that require but a few minutes. A month, they argue, is little enough for an expert foreman to classify justly the men under him, after observing their skill with his own eyes. When it is proposed that those who apply the tests for any trade need not themselves be skilled in it and may, in fact, know nothing about it, it is no wonder that they doubt the practicality of a method so foreign to previous conceptions and practice.

Psychologists have long realized that the same methods by which mental qualities, abilities, and capacities are determined, analyzed, and measured, could be applied to the measurement of manual dexterity or the combination of manual dexterity, judgment, perception, adaptability, and patience that, taken together, make the skilled workman. For, as the reader who has perused this book thus far will long since have recognized, there is in-

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cluded in the foregoing list of qualities a predominance of those which come quite definitely under the classification of mental abilities or capacities. As has been previously pointed out, it is impossible to separate mental and physical powers, and psychologists do not regard the mind as a separate entity, but merely as a convenient term for the definition of certain of the higher physical powers and their manifestations. And just as a certain type of nervous (physical) organism manifests itself in the development of abilities which we are accustomed to term "intellectual" or "mental," so the abilities which we call "physical" or "manual" are merely other manifestations of a different type of nervous organism.

The principal distinction, scientifically, between a trade test and an intelligence test, is in the purpose to be served by the test. In the intelligence test the aim is to ascertain the subject's general *capacity;* in the trade test, to discover his present *ability* or degree of skill in some special direction. Capacity, as has been previously pointed out, is only to be measured in terms of demonstrable ability, so that in the application of trade tests, although limited in their scope to a single class or kind of ability, there is also obtainable as a by-product a partial measure of the subject's mental capacity.

While trade tests devised by psychologists had been demonstrated, in a number of industries, to be superior to any other method, both in picking the most skilful workers from among all applicants for positions, and in transferring workers from one department to another in large industries, it was in the classification and placement of the personnel of the Army during the war that the first really large-scale demonstration of the precision and effectiveness of scientifically devised trade tests was made. While one group of psychologists, working under the direction of the Surgeon-General's Office, was engaged in classifying the Army personnel by means of intelligence tests the Personnel Branch of the Operations Division of the General Staff, organized and officered by trained psychologists, was

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undertaking the task of determining the special technical and vocational ability of the millions of men drawn into the Army through the medium of the selective draft.

This personnel organization had a multiplex duty to perform. First, it had to ascertain with precision what particular kinds of work had to be done in the preparation of an army for battle and in its transport and maintenance. This involved not only finding out just what needed to be done but translating this need into terms of trades and occupations.

For example, the Army might report that it needed a number of men capable of making all sorts of repairs to electric generators and motors. The Personnel Division proceeded to analyze the special qualifications required of electricians to enable them to meet this demand. These were listed, along with the qualifications required for every other army occupation, in a thick book entitled Trade Specifications Index. There were 239 pages in this book and in it were set forth in specific detail the exact qualifications needed by 565 different kinds of trade and technical experts. Chauffeurs, for instance, were classed as auto drivers, auto drivers with pigeon experience, motorcycle drivers with pigeon experience, plain motorcyclists, heavy auto-truck drivers, motor truck drivers, and plain chauffeurs. There were sixteen different classes of electricians, each of which required a man with special experience and knowledge. Nine different kinds of chemists were used in the Army.

It was a big job, in the first place, to determine exactly how men should be classified. After the classification had been decided upon, it then became necessary to devise simple, rapid, and accurate methods of placing every enlisted man in the Army in his proper classification, and then of so indexing three or four millions of men that any particular demand could be met. For example, one camp might ask for three farriers, nine sanitary engineers, two car carpenters, six boilermakers, and a pipe fitter. It was necessary that some system be perfected to permit of the filling of this order instantly by taking the men

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qualified to perform these duties out of the camps where they were undergoing military training.

The whole system had as its basis a card for each soldier, on which, by a simple system of marginal numbers, punch holes, and coloured index tags the record of each man's precise ability was kept. Every man, as he was inducted into the service, was required first to make a preliminary, rough classification of himself—that is to say, he recorded himself as a tailor, a blacksmith, or a milk wagon driver. But the Trade Specifications Index was as precise in its detail as a dictionary. It was, in fact, a collection of definitions of what was meant by occupational titles which had vague or various meanings in different parts of the country. Thus, a man might have classified himself as a tailor who, if called upon to make a uniform, would have been unable to do so. Tailoring had to be subdivided, from simple pressing and repairing up to expert fitting. One might be a good coat maker while another had never worked on anything but trousers.

So there was devised a system of trade and occupational tests to which every man claiming skill at a trade was subjected, and which determined, as nearly as it is humanly possible to do, exactly the degree and kind of vocational skill possessed by every man in the Army.

When the problem of formulating tests was analyzed, it was seen that certain requirements were fundamental. Trade tests to be absolutely satisfactory,

1. Must differentiate between the various grades of skill;

2. Must produce uniform results in various places and in the hands of individuals of widely different characteristics;

3. Must consume the least amount of time and energy consistent with the best results.

Now it must be recognized that trades useful in the Army are of many kinds and of widely differing requirements. Trade ability in any one of them, however, means about the same thing. It means that the workman is not simply the possessor of a

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single item of information, nor simply able to execute one particular movement required by the trade, but that he has many items of information more or less systematized together with the ability to execute various movements not only singly but in combinations.

While there are all degrees of trade ability among the members of any trade, it is convenient to classify them in a few main groups. Ordinarily the terms Novice, Apprentice, Journeyman, and Journeyman Expert (or Expert) are employed. The Novice is a man who has no trade ability whatever, or at least none that could not be paralleled by practically any intelligent man. The Apprentice has acquired some of the elements of the trade but is not sufficiently skilled to be entrusted with an important task. The Journeyman is qualified to perform almost any work done by members of the trade. The Expert can perform quickly and with superior skill any work done by men in the trade.

It is sometimes desirable that the Trade test should differentiate between the skill of different members of the same group, for instance, of the journeyman group. It is essential that it should differentiate between the journeyman and the apprentice and the apprentice and the novice. Trade tests devised to make this classification are of three kinds: oral, picture, and performance.

The oral tests are most generally used because they are of low cost and they may be applied to a large number of men in a comparatively short time and without much equipment. They are satisfactory in determining the presence or absence of trade ability and in many instances determine the degree of ability with such accuracy that no other tests are required.

As a preliminary to the preparation of a trade test, there is required a thorough inquiry into the conditions of the trade. This inquiry has a threefold purpose:

1. To determine the feasibility of a test in this field. Does the trade actually exist as a recognized trade? It was found,

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for example, that the trade of gunsmith was not a recognized trade, though there were gun repairers.

2. To determine the elements which require and permit of testing. In other words, can men be graded in it according to degrees of skill? In some trades it was found that the trade required simply the performance of a single set of operations and there were no gradations among the members of the trade.

3. To determine the kinds of tests that can be used. Some trades, such as truck driving and typewriting, are mainly matters of skill, and for them performance tests are better than oral tests. Other trades, such as interior wiring and power-plant operation, are mainly matters of knowledge. For these trades oral and picture tests are best.

After having discovered by inquiry that the trade is a recognized trade and can be tested, information is collected from all available sources. In the Army's preparation of trade tests experts in the trade, trade union officials, the literature of the trade, trade school authorities, employers, and the like were consulted. In this way it was discovered what are the elements of the trade and what constitutes proficiency in it.

As a result of this collection of information it was possible to compile a number of questions, usually from forty to sixty, each of which called for an answer that showed knowledge of the trade. Experience in the formulation of such questions has shown that a good question meets the following requirements:

1. It must be in the language of the trade.

2. It must be a unit, complete in itself and requiring no further explanation.

3. It must not be a chance question that could be answered by a good guess. The extreme example would be a question calling for the answer "yes" or "no."

4. It must be as short as possible and must be capable of being answered by a very short answer.

5. It must not be ambiguous; the meaning must be unmistakable.

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After the large number of questions originally formulated has been sifted down by application of the requirements stated above and others of less importance they are used in a preliminary sampling on a number of artisans engaged in the trade, usually from nine to twelve, whose answers indicate the merits of the different questions and their grades, from easy to difficult. In this sampling, tradesmen from different shops or plants are tried in order to guard against specialized methods or modes of expression confined to a single locality. At least two examiners worked on each set of questions at this stage, in the Army's work, to get the benefit of more than one point of view for revision.

This preliminary sampling affords a means of checking on the following points:

1. Is the test applicable to trade conditions?
2. Does the test represent good trade practice?
3. In what way can parts be profitably modified, supplemented, or eliminated?
4. Does the test represent the whole range of the trade, from the novice to the expert?
5. Is it a representative sampling of the whole range of trade processes?

In the light of the answers to these questions, the test is revised during this sampling process and is then ready to be formulated. This formulation consists of limiting the questions to a small enough number to be handled in a short space of time and to a wide enough range to represent every possible degree of trade skill. The questions are tabulated and are then ready to be used in the final sampling process.

Final sampling is made by testing twenty men who are known to be typical representatives of each group (novice, apprentice, journeyman, expert). Among the novices tested are some highly intelligent and mature men of good general knowledge but no trade ability. Three testing stations were used in the Army's work: one in Cleveland, one in Newark, and one in

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Pittsburgh, in order to get the benefit of wide geographical distribution. Examinations were given to men whose record in the trade was already known and who were tested as nearly as possible in the same manner as men in the camps.

The results of this final sampling are turned over to experts who make a careful study of the results and of the answers to each question. This enables them to determine the relative value of each individual question and the selection that makes a proper balance.

If a trade test is good, a known expert, when tested, is able to answer all, or nearly all, the questions correctly; a journeyman is able to answer the majority; an apprentice a smaller part, and a novice practically none. This does not mean that each question should be answered correctly by all the experts, a majority of the journeymen, some apprentices but no novices. There are a few questions which show this general result. A graphic curve when plotted for such a question is almost a straight line.

Other types of questions, however, are more common. Some show a distinct line of cleavage between the novice and the apprentice. Novices fail, but apprentices, journeymen, and experts alike answer correctly. There are likewise questions that are answered correctly by nearly all journeymen and experts but only a few apprentices, and questions that only an expert can answer correctly.

Each type of question has its value in a good test. The main requirement is that the tendency of the curve should be upward; a question which is answered correctly by more journeymen than experts or more apprentices than journeymen is undesirable and is at once discarded. A proper balance is made of the others.

One task still remains; namely, that of calibrating the test. As each question is allowed four points, it becomes necessary to determine how many points should indicate an expert, how many a journeyman, etc. Obviously the way to do this is to note how

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many points were scored by the known experts and the known journeymen when they were tested. Ordinarily the expert scores higher than the journeyman and the journeyman higher than the apprentice. It frequently happens that a few journeymen score as high as the lowest of the experts and a few apprentices as high as the lowest of the journeymen. There are consequently certain overlappings between the classes. In calibrating, the object is to draw the dividing line between classes so that the overlapping shall be as small as possible.

When these dividing lines, or *critical scores* as they are usually called, are established, the test is ready for editing, printing, and distribution to camps.

Picture tests are made in practically the same way as oral tests. The peculiar characteristic of picture tests is that the questions making up the tests relate to illustrations of trade tools and appliances.

The performance tests are now being used in many trades for those who make a satisfactory showing in the oral or picture tests. These performance tests are devised by conference with experts in the trade. They consist of some apparently simple tasks that can be performed quickly and with a small amount of apparatus but that nevertheless indicate clearly the degree of skill of the performer. As a result of experience the following have been drawn up as the requirements for a good performance test:

1. It should require the smallest possible quantity of tools and materials and these should be capable of standardization;

2. A journeyman should not require more than 45 minutes to perform it;

3. It should be typical of the work required;

4. The operations should be exact so that a correct standard form of product is always obtainable. Performance tests undergo much the same processes of sampling as do the oral and picture tests and they are calibrated in the same way. The principle followed here, as elsewhere, is that the value of a test

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lies not in its theoretical exactness but in its proved ability to pick out and classify correctly men of all degrees of skill within the trade. If the test does classify men in the groups in which they are known to belong, then it can be relied upon to classify correctly men about whom nothing is known in advance.

The method which the Army pursued is adaptable for any private enterprise. The work done under the direction of the Army General Staff in analyzing the essentials of nearly seven hundred trades and subdivisions of trades and in preparing tests for a large proportion of these was pioneer work, the results of which, in the shape of the tests themselves, while not issued for general distribution, are available as a time-saving guide to those who are interested in the building and application of trade tests.

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APPENDICES

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APPENDIX A

Intelligence Ratings in the Army

Reprinted from The Personnel Manual

(Vol. II of The Personnel System of the United States Army)

Purpose of the Intelligence Tests.—Under the direction of the Division of Psychology, Medical Department, and in accordance with provisions of General Order No. 74, mental tests are given all recruits during the two-weeks detention period. These tests provide an immediate and reasonably dependable classification of the men according to *general intelligence.* Their specific purposes are to aid:—

(1) In the discovery of men whose superior intelligence suggests their consideration for advancement;

(2) In the prompt selection and assignment to Development Battalions of men who are so inferior mentally that they are suited only for selected assignments;

(3) In forming organizations of uniform mental strength where such uniformity is desired;

(4) In forming organizations of superior mental strength where such superiority is demanded by the nature of the work to be performed;

(5) In selecting suitable men for various army duties or for special training in colleges or technical schools;

(6) In the early formation of training groups within a company in order that each man may receive instruction and drill according to his ability to profit thereby;

(7) In the early recognition of slow-thinking minds which might otherwise be mistaken for stubborn or disobedient characters;

(8) In eliminating from the army those men whose low-grade intelligence renders them either a burden or a menace to the service.

Nature of the Tests.—The tests were prepared by a special committee of the American Psychological Association. Before being ordered into general use they were thoroughly tried out in four National Army Cantonments, and from time to time have undergone revision to increase their practical usefulness.

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Between May 1 and October 1, 1918, approximately one million three hundred thousand men were tested.

Three systems of test are now in use:—

(1) *Alpha.* This is a group test for men who read and write English. It requires only fifty minutes, and can be given to groups as large as 500. The test material is so arranged that each of its 212 questions may be answered without writing, merely by underlining, crossing out, or checking. The papers are later scored by means of stencils, so that nothing is left to the personal judgment of those who do the scoring. The mental rating which results is therefore wholly objective.

(2) *Beta.* This is a group test for foreigners and illiterates. It may be given to groups of from 75 to 300 and requires approximately fifty minutes. Success in Beta does not depend upon knowledge of English, as the instructions are given entirely by pantomime and demonstration. Like Alpha, it measures general intelligence, but does so through the use of concrete or picture material instead of by the use of printed language. It is also scored by stencils and yields an objective rating.

(3) *Individual Tests.* Three forms of individual tests are used: The Yerkes-Bridges Point Scale, the Stanford-Binet Scale, and the Performance Scale. An individual test requires from fifteen to thirty minutes. The instructions for the Performance Scale are given by means of gestures and demonstration, and a high score may be earned in it by an intelligent recruit who does not know a word of English.

All enlisted men are given either Alpha or Beta according to their degree of literacy. Those who fail in Alpha are given Beta, and those who fail to pass Test Beta are given an individual test.

As a result of the tests, each man is rated as A, B, C+, C, C—, D, D— or E. The letter ratings are reported to the Interviewing Section of the Personnel Office, and are there copied on the Qualification Cards (in the square marked Intelligence). The Psychological Report, after the grades have been copied on the Qualification Cards, is forwarded from the Interviewing Section to the Mustering Section of the Personnel Office, where each soldier's letter rating is copied on the second page of his Service Record. A copy of the Psychological Report is also sent by the Psychological Examiner to the Company Commander, who uses it in the organization of his company. In some camps the entering of Intelligence Grades on Service Records has been left to company commanders, but accuracy and uniformity is secured by having these grades entered in the Mustering Section of the Personnel Office when the Service Records are being started.

The psychological staff in a camp is ordinarily able to test 2,000 men per day and to report the ratings to the Personnel Office within 24 hours. Personnel Adjutants will coöperate in arranging the schedule of psychological examinations

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so as to secure from them maximum value (See Chapter IV for the proper coördination of the work of the Psychological Examiner with the work of other officers in a camp.)

Explanation of letter ratings.—The rating a man earns furnishes a fairly reliable index of his *ability to learn, to think quickly and accurately, to analyze a situation, to maintain a state of mental alertness, and to comprehend and follow instructions.* The score is little influenced by schooling. Some of the highest records have been made by men who had never completed the eighth grade. The meaning of the letter ratings is as follows:

A. *Very Superior Intelligence.* This grade is earned by only four or five soldiers out of a hundred. The "A" group is composed of men of marked intellectuality. "A" men are of high officer type when they are also endowed with leadership and other necessary qualities.

B. *Superior Intelligence.* "B" intelligence is superior, but less exceptional than that represented by "A." The rating "B" is obtained by eight to ten soldiers out of a hundred. The group contains a good many men of the commissioned officer type and a large amount of non-commissioned officer material.

C+. *High Average Intelligence.* This group includes about fifteen to eighteen per cent. of all soldiers and contains a large amount of non-commissioned officer material with occasionally a man whose leadership and power to command fit him for commissioned rank.

C. *Average Intelligence.* Includes about twenty-five per cent. of soldiers. Excellent private type with a certain amount of fair non-commissioned officer material.

C—. *Low Average Intelligence.* Includes about twenty per cent. While below average in intelligence, "C—" men are usually good privates and satisfactory in work of routine nature.

D. *Inferior Intelligence.* Includes about fifteen per cent. of soldiers. "D" men are likely to be fair soldiers, but are usually slow in learning and rarely go above the rank of private. They are short on initiative and so require more than the usual amount of supervision. Many of them are illiterate or foreign.

D— and E. *Very Inferior Intelligence.* This group is divided into two classes (1) "D—" men, who are very inferior in intelligence but are considered fit for regular service; and (2) "E" men, those whose mental inferiority justifies their recommendation for Development Battalion, Special Service Organization, rejection, or discharge. The majority of "D—" and "E" men are below ten years in "mental age."

The immense contrast between "A" and "D—" intelligence is shown by the fact that men of "A" intelligence have the ability to make a superior record in college or university, while "D—" men are of such inferior mentality that they are

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rarely able to go beyond the third or fourth grade of the elementary school, however long they attend. In fact, most "D—" and "E' men are below the "mental age" of ten years and at best are on the border-line of mental deficiency. Most of them are of the "moron" grade of feeble-mindedness. "B" intelligence is capable of making an average record in college, "C+" intelligence cannot do so well, while mentality of the "C" grade is rarely equal to high school graduation.

Evidence that the Tests Measure Military Value.—It has been thoroughly demonstrated that the intelligence ratings are very useful in indicating practical military value. The following investigations are typical:

1. Commanding officers of ten different organizations representing various arms in a camp were asked to designate:

(*a*) The most efficient men in the organization;

(*b*) Men of average value;

(*c*) Men so inferior that they were "barely able" to perform their duties.

The officers of these organizations had been with their men from six to twelve months and knew them exceptionally well. The total number of men rated was 965, about equally divided among "best," "average," and "poorest." After the officers' ratings had been made, the men were given the usual psychological test. Comparison of test results with officers' ratings showed:

(*a*) That the average score of the "best" group was approximately twice as high as the average score of the "poorest" group.

(*b*) That of men testing below "C—" 70 per cent. were classed as "poorest" and only 4.4 per cent. as "best."

(*c*) That of men testing above "C+," 15 per cent. were classed as "poorest" and 55.5 per cent. as "best."

(*d*) That the man who tests above "C+" is about fourteen times as likely to be classed "best" as the man who tests below "C—."

(*e*) That the per cent. classed as "best" in the various letter groups increased steadily from 0 per cent. in "D—" to 57.7 per cent. in "A," while the per cent. classed as "poorest" decreased steadily from 80 per cent. in "D—" to 11.5 per cent. in "A." The following table shows the per cents. for each letter group:

	D—	D	C—	C	C+	B	A
Total number	29	60	121	231	229	191	104
Classed with "best"	0.0%	6.7%	19.0%	26.0%	39.3%	53.4%	57.7%
Classed with "poorest"	79.3%	65.0%	57.9%	31.2%	24.9%	16.7%	11.5%

Considering that low military value may be caused by many things besides inferior intelligence, the above findings are very significant.

2. In an infantry regiment of another camp were 765 men (Regulars) who had

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been with their officers for several months. The company commanders were asked to rate these men as 1, 2, 3, 4, or 5 according to "practical soldier value," "1" being highest, and "5" lowest. The men were then tested, with the following results:

(*a*) Of 76 men who earned the grade A or B, none was rated "5" and only 9 were rated "3" or "4."

(*b*) Of 238 "D" and "D—" men, only one received the rating "1" and only 7 received a rating of "2."

(*c*) Psychological ratings and ratings by company commanders were identical in 49.5 per cent. of all cases. There was agreement within one step in 88.4 per cent. of cases, and disagreement of more than two steps in only $\frac{7}{10}$ of 1 per cent. of cases.

3. In another camp the company officers of a regiment were asked to designate the ten "best" and ten "poorest" privates in each company. The officers had been with their men long enough to know them thoroughly. Comparison of the officers' estimates with the results of intelligence tests brought out the following facts:

(*a*) Of 156 men classed with the ten "best" in their respective companies, only 9 tested below C—.

(*b*) Of 133 men classed with the "poorest" ten in their respective companies, only 4 tested above C+.

(*c*) Men above C+ are 7.3 times as likely as men below C— to be classed with the ten "best."

(*d*) Men below C— are 10.8 times as likely as men above C+ to be classed with the ten "poorest."

(*e*) An "A" man is 11.7 times as likely as a man below C— to be rated "best"; but a man below C— is 13.5 times as likely as an "A" to be rated "poorest."

4. The same experiment was made in still another camp. Officers of 36 different companies picked the ten "best" and the ten "poorest" men in each company. Of the "poorest," 62.22 per cent. tested below C— and only 3.06 per cent. above C+. Of the "best," 38 per cent. tested above C+ and only 9.72 per cent. below C—. According to this investigation, a man below C— is 6.4 times as likely to be "poorest" as to be "best." A man above C+ is 12.5 times as likely to be "best" as to be "poorest." A man rating A is 62 times as likely to be "best" as to be "poorest." A man rating D— is 29.3 times as likely to be "poorest" as to be "best."

5. Where commissioned officers are selected on the basis of trying out and "survival of the fittest" it is ordinarily found that about 80 per cent. are of the A or B grade, and only about 5 per cent. below the C+ grade. Of non-commissioned officers chosen by this method, about 75 per cent. are found to

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grade A, B, or C+, and only 5 per cent below C. Moreover, there is a gradual rise in average score as we go from privates up through the ranks of privates first class, corporals, sergeants first class, O. T. S. candidates, and commissioned officers. This is seen in the following table:

	PER CENT. EARNING EACH LETTER RATING							
Various Groups (Whites) .	D—or E	D	C—	C	C+	B	A	A and B
8,319 Commissioned Officers	0.0	0.01	.25	2.92	13.8	34.6	48.4	83.
9,240 O. T. S. Candidates .	0.0	0.14	.98	6.16	19.5	36.4	36.8	73.2
3,593 Sergeants . . .	0.0	1.05	4.05	14.2	27.3	32.5	20.9	53.4
4,023 Corporals . . .	0.0	1.33	7.33	20.33	31.3	26	13.7	39.7
31,114 Literate Privates .	0.22	10.24	21.48	28.79	20.48	12.28	6.37	18.75
10,806 Illiterate Privates .	7.8	41.16	29.11	14.67	4.43	1.95	.52	2.47

6. Experience shows that "D" candidates admitted to Officers' Training Schools almost never make good, and that the per cent. of elimination among the "C—" and "C" students is several times as high as among "A" students. For example, in one of the Fourth Officers' Training Schools 100 per cent. of the "D" men were eliminated as unsatisfactory, 55 per cent. of the "C—" men, 14.8 per cent. of the "B" men, but only 2.7 per cent. of the "A" men. In another Fourth Officers' Training School 76.2 per cent. of the men rating below C were eliminated in the first six weeks, 51.5 per cent. of the "C" men, and none at all of the "A" or "B" men. These findings are typical.

The psychological ratings are valuable not so much because they make a better classification than would come about in the course of time through natural selection, but chiefly because they greatly abbreviate this process by indicating *immediately* the groups in which suitable officer material will be found, and at the same time those men whose mental inferiority warrants their elimination from regular units in order to prevent the retardation of training. Speed counts in a war that costs fifty million dollars per day and requires the minimum period of training.

Directions for the Use of Intelligence Ratings.—In using the intelligence ratings the following points should be borne in mind:

1. The mental tests are not intended to replace other methods of judging a man's value to the service. It would be a mistake to assume that they tell us infallibly what kind of soldier a man will make. They merely *help* to do this by measuring one important element in a soldier's equipment, namely, intelligence. They do not measure loyalty, bravery, power to command, or the emotional traits that make a man "carry on." However, in the long run these qualities are far more likely to be found in men of superior intelligence than in men who are intellectually inferior. Intelligence is perhaps the most important *single* factor in soldier efficiency apart from physical fitness.

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2. Commissioned officer material is found chiefly in the A and B groups, although of course not all high-score men have the other qualifications necessary for officers. Men below C+ should not be accepted as students in Officers' Training Schools unless the score on the Officers' Rating Scale indicates exceptional power of leadership and ability to command.

3. Since more than one fourth of enlisted men rate as high as C+, there is rarely justification for going below this grade in closing non-commissioned officers. This is especially the case in view of the likelihood of promotion from non-commissioned rank. Even apart from considerations of promotion, it is desirable to avoid the appointment of mentally inferior men (below C) as non-commissioned officers. Several careful studies have shown that "C—" and "D" sergeants and corporals are extremely likely to be found unsatisfactory. The fact that a few make good does not justify the risk taken in their appointment.

4. Men below C+ are rarely equal to complicated paper work.

5. In selecting men for tasks of special responsibility the preference should be given to those of highest intelligence rating *who also have the other necessary qualifications*. If they make good they should be kept on the work or promoted; if they fail they should be replaced by men next on the list.

To aid in selecting men for occupational assignment, extensive data have been gathered on the range of intelligence scores found in various occupations. This material has been placed in the hands of the Personnel Officers for use in making assignments. It is suggested that those men who have an intelligence rating above the average in an occupation should be the first to be assigned to meet requirements in that occupation, and after that men with lower ratings should be considered.

6. In making assignments from the Depot Brigade to permanent organizations it is important to give each unit its proportion of superior, average, and inferior men. If this matter is left to chance there will inevitably be "weak links" in the army chain.

Exceptions to this rule should be made in favour of certain arms of the service which require more than the ordinary number of mentally superior men; e. g., Signal Corps, Machine Gun, Field Artillery and Engineers. These organizations ordinarily have about twice the usual proportion of "A" and "B" men and very much less than the usual proportion of "D" and "D—" men.

The first two columns in the following table illustrate the distribution of intelligence grades typical of infantry regiments and also the extreme differences in the mental strength of organizations which are built up without regard to

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intelligence ratings. The last column to the right shows a balanced distribution of intellectual strength which might have been made to each of these two regiments.

Intelligence Rating	Interpretation	Actual Distribution		Balanced Distribution
		1st Regiment	2d Regiment	
A	Very Superior	1.0%	6.0%	3.5%
B	Superior	3.0	12.0	7.5
C+	High Average	7.0	20.0	13.5
C	Average	15.0	28.0	21.5
C—	Low Average	25.0	19.0	22.0
D	Inferior	31.0	13.0	22.0
D—	Very Inferior	18.0	2.0	10.0

Unless intelligence is wisely distributed certain regiments and companies will take training much more slowly than others and thus delay the programme of the whole organization.

7. "D" and "D—" men are rarely suited for tasks which require special skill, resourcefulness, or sustained alertness. It is also unsafe to expect "D," "D—" or "E" men to read or understand written directions.

8. Only high-score men should be selected for tasks that require quick learning or rapid adjustments.

9. It should not be supposed that men who receive the same mental rating are necessarily of equal military worth. *A man's value to the service should not be judged by his intelligence alone.*

10. The intelligence rating is one of the most important aids to the Personnel Office in the rapid sorting of the masses of men in the Depot Brigade. *In no previous war has so much depended on the prompt and complete utilization of the mental ability of the individual soldier.* It is expected, therefore, that the psychological ratings will be regularly used as an aid in the selection, assignment, and classification of men.

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APPENDIX B

The Army "Alpha" and "Beta" Tests

With Instructions and Method of Scoring

Instructions for giving Alpha Test 1. (To be read aloud by Examiner.)

TEST 1, FORM 8.

1. "Attention! 'Attention' always means 'Pencils up.' Look at the circles at 1. When I say 'go,' but not before, make a figure 2 in the second circle and also a cross in the third circle.—Go!" (Allow not over 5 seconds.)

2. "Attention! Look at 2, where the circles have numbers in them. When I say 'go' draw a line from Circle 1 to Circle 4 that will pass *below* Circle 2 and *above* Circle 3.—Go!" (Allow not over 5 seconds.)

3. "Attention! Look at the square and triangle at 3. When I say 'go' make a figure 1 in the space which is in the square but not in the triangle, and also make a cross in the space which is in the triangle and in the square.—Go!" (Allow not over 10 seconds.)

4. "Attention! Look at 4. When I say 'go' make a figure 2 in the space which is in the circle but not in the triangle or square, and also make a figure 3 in the space which is in the triangle and circle, but not in the square.—Go!" (Allow not over 10 seconds.)

N. B. *Examiner.*—In reading 5, don't pause at the word "circle" as if ending a sentence.

5. "Attention! Look at 5. If 'taps' sounds in the evening, then (when I say 'go') put a cross in the first circle; if not, draw a line *under* the word No.—Go!" (Allow not over ten seconds.)

6. "Attention! Look at 6. When I say 'go' put in the first circle the right answer to the question: 'How many months has a year?' In the second circle do nothing, but in the fifth circle put any number that is wrong answer to the question that you just answered correctly—Go!" (Allow not over 10 seconds.)

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FORM 8 GROUP EXAMINATION ALPHA GROUP NO.

Name _____ Rank _____ Age _____

Company _____ Regiment _____ Arm _____ Division _____

In what country or state born? _____ Years in U. S.? _____ Race _____

Occupation _____ Weekly Wages _____

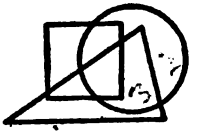
Schooling: Grades, 1. 2. 3. 4. 5. 6. 7. 8: High or Prep. School, Year 1. 2. 3. 4: College, Year 1. 2. 3. 4.

TEST 1

1. ○ ○ ○ ○ ○

2. ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

3.

4. 

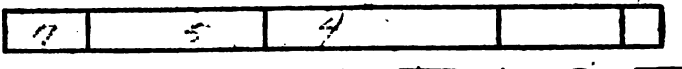
5. ○ ○ ○ Yes No

6. ○ ○ ○ ○ ○

7. A B C D E F G H I J K L M N O P

8. ○ ○ ○ MILITARY GUN CAMP

9. 34-79-56-87-68-25-82-47-27-31-64-93-71-41-82-99

10. 

11. 7F 4 3 5A 8 2 6 9B 3

12. 1 2 3 4 5 6 7 8 9

Division of Psychology, Medical Department U. S. A.
Authorized by the Surgeon General, Feb. 6, 1918, Edition, May 20, 1918, 10,000

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7. "Attention! Look at 7. When I say 'go' *cross out* the letter just after F and also draw a line *under* the second letter after I.—Go!" (Allow not over 10 seconds.)

8. "Attention! Look at 8. Notice the three circles and the three words. When I say 'go' make in the *first* circle the *last* letter of *first* word; in the *second* circle the *middle* letter of the second word, and in the *third* circle the first letter of the *third* word.—Go!" (Allow not over 10 seconds.)

9. "Attention! Look at 9. When I say 'go' *cross out* each number that is more than 50 but less than 60.—Go!" (Allow not over 15 seconds.)

10. "Attention! Look at 10. Notice that the drawing is divided into five parts. When I say 'go' put a 4 or a 5 in each of the two largest parts and any number between 6 and 9 in the part next in size to the smallest part.—Go!" (Allow not over 15 seconds.)

11. "Attention! Look at 11. When I say 'go' draw a line through every odd number that is not in a square, and also through every odd number that is in a square with a letter.—Go!" (Allow not over 25 seconds.)

12. "Attention! Look at 12. If 4 is more than 2, then (when I say 'go') cross out the number 3 unless 3 is more than 5, in which case draw a line *under* the number 4.—Go!" (Allow not over 10 seconds.)

"During the rest of this examination don't turn any page forward or backward unless you are told to. Now turn over the page to Test 2."

Instructions for Giving Alpha Test 2.

TEST 2.—ARITHMETICAL PROBLEMS

"Attention! Look at the directions at the top of the page while I read them. Get the answers to these examples as quickly as you can. Use the side of this page to figure on if you need to. I will say stop at the end of five minutes. You may not be able to finish all of them, but do as many as you can in the time allowed. The two samples are already answered correctly.—Ready—Go!"

After 5 minutes, say "Stop! Turn over the page to Test 3."

Instructions for Giving Alpha Test 3.

TEST 3.—PRACTICAL JUDGMENT

"Attention! Look at the directions at the top of the page while I read them. This is a test of common sense. Below are sixteen questions. Three answers

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TEST 2

Get the answers to these examples as quickly as you can. Use the side of this page to figure on if you need to.

SAMPLES
1 How many are 5 men and 10 men?.....Answer (15)
2 If you walk 4 miles an hour for 3 hours, how far do you walk?.....Answer (12)

1 How many are 60 guns and 5 guns?.....Answer (65)
2 If you save $9 a month for 3 months, how much will you save?.....Answer (27)
3 If 48 men are divided into squads of 8, how many squads will there be?.....Answer (6)
4 Mike had 11 cigars. He bought 2 more and then smoked 7. How many cigars did he have left?.....Answer (6)
5 A company advanced 8 miles and retreated 2 miles. How far was it then from its first position?.....Answer (6)
6 How many hours will it take a truck to go 42 miles at the rate of 3 miles an hour?.....Answer (14)
7 How many pencils can you buy for 60 cents at the rate of 2 for 5 cents?.....Answer (24)
8 A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day 6 miles, the third 10 miles, the fourth 6 miles. How many miles did they march the last day?.....Answer (9)
9 If you buy 2 packages of tobacco at 8 cents each and a pipe for 65 cents, how much change should you get from a two-dollar bill?.....Answer (1.19)
10 If it takes 4 men 3 days to dig a 120-foot drain, how many men are needed to dig it in half a day?.....Answer (24)
11 A dealer bought some mules for $2,000. He sold them for $2,400, making $50 on each mule. How many mules were there?.....Answer (8)
12 A rectangular bin holds 200 cubic feet of lime. If the bin is 10 feet long and 5 feet wide, how deep is it?.....Answer (4)
13 A recruit spent one-eighth of his spare change for post cards and twice as much for a box of letter paper, and then had $1.00 left. How much money did he have at first?.....Answer ( )
14 If 3½ tons of clover cost $14, what will 6½ tons cost?..Answer (26)
15 A ship has provisions to last her crew of 700 men 2 months. How long would it last 400 men?.....Answer (3½)
16 If an aeroplane goes 250 yards in 10 seconds, how many feet does it go in a fifth of a second?.....Answer (15)
17 A U-boat makes 8 miles an hour under water and 20 miles on the surface. How long will it take to cross a 100-mile channel, if it has to go two-fifths of the way under water?..Answer ( )
18 If 134 squads of men are to dig 3,618 yards of trench, how many yards must be dug by each squad?.....Answer ( )
19 A certain division contains 5,000 artillery, 15,000 infantry, and 1,000 cavalry. If each branch is expanded proportionately until there are in all 23,100 men, how many will be added to the artillery?.....Answer ( )
20 A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 37 mess halls. Of this remainder each mess hall received 54 barrels. What was the total number of barrels supplied?..Answer ( )

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TEST 3

This is a test of common sense. Below are sixteen questions. Three answers are given to each question. You are to look at the answers carefully; then make a cross in the square before the best answer to each question, as in the sample:

SAMPLE
Why do we use stoves? Because
- ☐ they look well
- ☒ they keep us warm
- ☐ they are black

Here the second answer is the best one and is marked with a cross. Begin with No. 1 and keep on until time is called.

1 It is wiser to put some money aside and not spend it all, so that you may
- ☒ prepare for old age or sickness
- ☐ collect all the different kinds of money
- ☐ gamble when you wish

2 Shoes are made of leather, because
- ☐ it is tanned
- ☒ it is tough, pliable and warm
- ☐ it can be blackened

3 Why do soldiers wear wrist watches rather than pocket watches? Because
- ☐ they keep better time
- ☐ they are harder to break
- ☒ they are handier

4 The main reason why stone is used for building purposes is because
- ☐ it makes a good appearance
- ☒ it is strong and lasting
- ☐ it is heavy

5 Why is beef better food than cabbage? Because
- ☐ it tastes better
- ☒ it is more nourishing
- ☐ it is harder to obtain

6 If some one does you a favor, what should you do?
- ☐ try to forget it
- ☐ steal for him if he asks you to
- ☒ return the favor

7 If you do not get a letter from home which you know was written, it may be because
- ☒ it was lost in the mails
- ☐ you forgot to tell your people to write
- ☐ the postal service has been discontinued

8 The main thing the farmers do is to
- ☐ supply luxuries
- ☐ make work for the unemployed
- ☒ feed the nation

☞ Go to No. 9 above

9 If a man who can't swim should fall into a river, he should
- ☐ yell for help and try to scramble out
- ☐ dive to the bottom and crawl out
- ☒ lie on his back and float

10 Glass insulators are used to fasten telegraph wires because
- ☐ the glass keeps the pole from being burned
- ☒ the glass keeps the current from escaping
- ☐ the glass is cheap and attractive

11 If your load of coal gets stuck in the mud, what should you do?
- ☐ leave it there
- ☒ get more horses or men to pull it out
- ☐ throw off the load

12 Why are criminals locked up?
- ☒ to protect society
- ☐ to get even with them
- ☐ to make them work

13 Why should a married man have his life insured? Because
- ☐ death may come at any time
- ☐ insurance companies are usually honest
- ☒ his family will not then suffer if he dies

14 In Leap Year February has 29 days because
- ☒ February is a short month
- ☐ some people are born on February 29th
- ☒ otherwise the calendar would not come out right

15 If you are held up and robbed in a strange city, you should
- ☒ apply to the police for help
- ☐ ask the first man you meet for money to get home
- ☐ borrow some money at a bank

16 Why should we have Congressmen? Because
- ☐ the people must be ruled
- ☐ it insures truly representative government
- ☒ the people are too many to meet and make their laws

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are given to each question. You are to look at the answers carefully; then make a cross in the square before the *best* answer to each question, as in the sample:

"'Why do we use stoves? Because

☐ they look well
☐ they keep us warm
☐ they are black

"'Here the second answer is the best one and is marked with a cross.

"'Begin with No. 1 and keep on until time is called.'—Ready—Go!" After 1½ minutes, say "Stop! Turn over the page to Test 4."

Instructions for Giving Alpha Test 4.

TEST 4.—SYNONYM—ANTONYM

"Attention! Look at the directions at the top of the page while I read them." (Examiner.—Read slowly.)

"If the two words of a pair mean the same or nearly the same draw a line under "same." If they mean the opposite or nearly the opposite, draw a line under "opposite." If you cannot be sure, guess. The two samples are already marked as they should be.'—Ready—Go!"

After 1½ minutes, say "Stop! Turn over the page to Test 5." (Pause.) "Now you have to turn your books around this way." (Examiner illustrates the necessary rotation.)

Instructions for Giving Alpha Test 5.

TEST 5—DISARRANGED SENTENCES

"Attention! Look at the directions at the top of the page while I read them." (Examiner.—Read slowly.)

"The words *a eats cow grass* in that order are mixed up and don't make a sentence; but they would make a sentence if put in the right order: *a cow eats grass*, and this statement is true.

"Again, the words *horses feathers have all* would make a sentence if put in the order *all horses have feathers*, but this statement is false.

"Below are 24 mixed-up sentences. Some of them are true and some are false. When I say 'go,' take these sentences one at a time. Think what each *would* say if the words were straightened out, but don't write them yourself. Then, if what it would say is true draw a line under the word 'true'; if what it would say is false, draw a line under the word 'false.' If you cannot be sure, guess. The two samples are already marked as they should be. Begin with No. 1 and work right down the page until time is called. 'Ready—Go!'"

After 2 minutes, say "Stop! Turn over the page to Test 6."

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TEST 4

If the two words of a pair mean the same or nearly the same, draw a line under *same*. If they mean the opposite or nearly the opposite, draw a line under *opposite*. If you cannot be sure, guess. The two samples are already marked as they should be

---

SAMPLES	good—bad	same—opposite	
	little—small	same—opposite	
1	no—yes	same—opposite	1
2	day—night	same—opposite	2
3	go—leave	same—opposite	3
4	begin—commence	same—opposite	4
5	bitter—sweet	same—opposite	5
6	assume—suppose	same—opposite	6
7	command—obey	same—opposite	7
8	tease—please	same—opposite	8
9	diligent—industrious	same—opposite	9
10	corrupt—honest	same—opposite	10
11	toward—from	same—opposite	11
12	masculine—feminine	same—opposite	12
13	complex—simple	same—opposite	13
14	sacred—hallowed	same—opposite	14
15	often—seldom	same—opposite	15
16	ancient—modern	same—opposite	16
17	enormous—gigantic	same—opposite	17
18	confer—grant	same—opposite	18
19	acquire—lose	same—opposite	19
20	compute—calculate	same—opposite	20
21	defile—purify	same—opposite	21
22	apprehensive—fearful	same—opposite	22
23	sterile—fertile	same—opposite	23
24	chasm—abyss	same—opposite	24
25	somber—gloomy	same—opposite	25
26	vestige—trace	same—opposite	26
27	vilify—praise	same—opposite	27
28	finite—limited	same—opposite	28
29	contradict—corroborate	same—opposite	29
30	immune—susceptible	same—opposite	30
31	credit—debit	same—opposite	31
32	assiduous—diligent	same—opposite	32
33	transient—permanent	same—opposite	33
34	palliate—mitigate	same—opposite	34
35	execrate—revile	same—opposite	35
36	extinct—extant	same—opposite	36
37	pertinent—relevant	same—opposite	37
38	synchronous—simultaneous	same—opposite	38
39	supercilious—disdainful	same—opposite	39
40	abstruse—recondite	same—opposite	40

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TEST 5

The words A EATS COW GRASS in that order are mixed up and don't make a sentence; but they would make a sentence if put in the right order: A COW EATS GRASS, and this statement is true.

Again, the words HORSES FEATHERS HAVE ALL would make a sentence if put in the order: ALL HORSES HAVE FEATHERS, but this statement is false.

Below are twenty-four mixed-up sentences. Some of them are true and some are false. When I say "go," take these sentences one at a time. Think what each would say if the words were straightened out, but don't write them yourself. Then, if what it would say is true, draw a line under the word "true"; if what it would say is false, draw a line under the word "false." If you can no' e sure, guess. The two samples are already marked as they should be. Begin with No. 1 and work right down the page until time is called.

SAMPLES	a eats cow grass	true	false	
	horses feathers have all	true	false	
1	oranges yellow are	true	false	1
2	hear are with to ears	true	false	2
3	noise cannon never make a	true	false	3
4	trees in nests build birds	true	false	4
5	oil water not and will mix	true	false	5
6	bad are shots soldiers all	true	false	6
7	fuel wood are coal and for used	true	false	7
8	moon earth the only from feet twenty the is	true	false	8
9	to life water is necessary	true	false	9
10	are clothes all made cotton of	true	false	10
11	horses automobile an are than slower	true	false	11
12	tropics is in the produced rubber	true	false	12
13	leaves the trees in lose their fall	true	false	13
14	place pole is north comfortable a the	true	false	14
15	sand of made bread powder and is	true	false	15
16	sails is steamboat usually by propelled a	true	false	16
17	is the salty in water all lakes	true	false	17
18	usually judge can we actions man his by a	true	false	18
19	men misfortune have good never	true	false	19
20	tools valuable is for sharp making steel	true	false	20
21	due sometimes calamities are accident to	true	false	21
22	forget trifling friends grievances never	true	false	22
23	feeling is of painful exaltation the	true	false	23
24	begin a and apple acorn ant words with the	true	false	24

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Instructions for Giving Alpha Test 6.

TEST 6.—NUMBER SERIES COMPLETION

(N. B. *Examiner.*—Give these instructions very slowly).

'Attention! Look at the first sample row of figures at the top of the page—2, 4, 6, 8, 10, 12, the two numbers that should come next are, of course, 14, 16.

"Look at the second sample—9, 8, 7, 6, 5, 4; the two numbers that should come next are 3, 2.

"Look at the third sample—2, 2, 3, 3, 4, 4; the two numbers that should come next are 5, 5.

"Now look at the fourth sample—1, 7, 2, 7, 3, 7; the next two numbers would, of course, be 4, 7.

"Look at each row of numbers below and on the two dotted lines write the two numbers that should come next.—Ready—Go!"

After 3 minutes, say "Stop! Turn over the page to Test 7."

Instructions for Giving Alpha Test 7

TEST 7.—ANALOGIES

"Attention! Look at the first sample at the top of the page: Sky—blue: : grass—table, *green*, warm, big.

"Notice the four words in heavy type. One of them—*green*—is underlined. Grass is *green* just as the sky is blue.

"Look at the second sample: Fish—swims : : man—paper, time, *walks*, girl.

"Here the word *walks* is underlined. A man walks and a fish swims.

"Look at the third sample: Day—night : : white—red, *black*, clear, pure.

"Here the word *black* is underlined because black is the opposite of white just as night is the opposite of day.

"In each of the lines below the first two words are related to each other in some way. What you are to do in each line is to see what the relation is between the first two words and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.—Ready—Go!"

After 3 minutes, say "Stop! Turn over the page to Test 8."

Instructions for Giving Alpha Test 8.

TEST 8.—INFORMATION

"Attention! Look at the directions at the top of the page while I read them." (Examiner.—Read slowly.)

"Notice the sample sentences: People hear with the—eyes—ears—nose—mouth. The correct word is *ears*, because it makes the truest sentence. In each

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TEST 6

SAMPLES	2	4	6	8	10	12	14	16
	9	8	7	6	5	4	3	2
	2	2	4	3	4	4	5	5
	1	7	2	7	3	7	4	7

Look at each row of numbers below, and on the two dotted lines write the two numbers that should come next.

3	4	5	6	7	8	9	10
8	7	6	5	4	3	2	1
10	15	20	25	30	35	40	45
3	3	7	7	5	5	3	3
3	6	9	12	15	18	21	24
3	1	6	1	4	1	2	1
3	9	13	17	21	25	29	33
3	9	12	13	16	17	20	21
27	27	23	23	19	19	15	15
1	2	4	8	16	32	64	128
19	16	14	11	9	6	4	1
11	13	12	14	13	15	14	16
2	3	5	8	12	17	23	30
13	14	17	13	16	12	15	11
29	28	26	23	19	14	8	1
20	17	15	14	11	9	6	5
31	27	9	3	1	½	¼	⅛
1	4	9	16	25	36	49	64
16	17	15	18	14	19	....	.....
3	6	8	16	18	36	.....	.....

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TEST 7

SAMPLES
sky—blue :: grass— table green warm big
fish—swims :: man— paper time walks girl
day—night :: white— red black clear pure

In each of the lines below, the first two words are related to each other in some way. What you are to do in each line is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

1	shoe—foot :: hat— kitten head knife penny	1
2	pup—dog :: lamb— red door sheep book	2
3	spring—summer :: autumn— winter warm harvest rise	3
4	devil—angel :: bad— mean disobedient defamed good	4
5	finger—hand :: toe— body foot skin nail	5
6	legs—frog :: wings— eat swim bird nest	6
7	chew—teeth :: smell— sweet stink odor nose	7
8	lion—roar :: dog— drive pony bark harness	8
9	eat—tiger :: dog— wolf bark bite map	9
10	good—bad :: long— tall big snake short	10
11	giant—large :: dwarf— jungle small beard ugly	11
12	winter—season :: January— February day month Christmas	12
13	skating—winter :: swimming— diving floating hole summer	13
14	blonde—light :: brunette— dark hair brilliant blonde	14
15	love—friend :: hate— malice stint enemy dislike	15
16	egg—bird :: seed— grow plant crack germinate	16
17	dig—trench :: build— run house spade bullet	17
18	agree—quarrel :: friend— comrade need mother enemy	18
19	palace—king :: hut— peasant cottage farm city	19
20	cloud-burst—shower :: cyclone— bath breeze destroy West	20
21	Washington—Adams :: first— president second last Bryan	21
22	parents—command :: children— men shall women obey	22
23	diamond—rare :: iron— common silver ore steel	23
24	yes—affirmative :: no— think knowledge yes negative	24
25	hour—day :: day— night week hour noon	25
26	eye—head :: window— key floor room door	26
27	clothes—man :: hair— horse comb beard hat	27
28	draw—picture :: make— destroy table break hard	28
29	automobile—wagon :: motorcycle— ride speed bicycle car	29
30	granary—wheat :: library— read books paper chairs	30
31	Caucasian—English :: Mongolian— Chinese Indian negro yellow	31
32	Indiana—United States :: part— hair China Ohio whole	32
33	esteem—despise :: friends— Quakers enemies lovers men	33
34	abide—stay :: depart— come hence leave late	34
35	abundant—scarce :: cheap— buy costly bargain nasty	35
36	whale—large :: thunder— loud rain lightning kill	36
37	reward—hero :: punish— God everlasting pain traitor	37
38	music—soothing :: noise— hear distracting sound report	38
39	book—writer :: statue— sculptor library picture state	39
40	wound—pain :: health— sickness disease exhilaration doctor	40

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EC 30
MM 34

TEST 8

Notice the sample sentence:

People hear with the eyes **ears** nose mouth

The correct word is ears, because it makes the truest sentence.

In each of the sentences below you have four choices for the last word. Only one of them is correct. In each sentence draw a line under the one of these four words which makes the truest sentence. If you can not be sure, guess. The two samples are already marked as they should be.

SAMPLES

People hear with the eyes **ears** nose mouth

France is in **Europe** Asia Africa Australia

1 The apple grows on a shrub vine bush tree.....
2 Five hundred is played with rackets pins cards dice.....
3 The Percheron is a kind of goat horse cow sheep.....
4 The most prominent industry of Gloucester is fishing packing brewing automobiles.
5 Sapphires are usually blue red green yellow.....

6 The Rhode Island Red is a kind of horse granite cattle fowl.....
7 Christie Mathewson is famous as a writer artist baseball player comedian.....
8 Revolvers are made by Swift & Co. Smith & Wesson W. L. Douglas B. T. Babbitt...
9 Carrie Nation is known as a singer temperance agitator suffragist nurse.....
10 "There's a reason" is an "ad" for a drink revolver flour cleanser.....

11 Artichoke is a kind of hay corn vegetable fodder.....
12 Chard is a fish lizard vegetable snake.....
13 Cornell University is at Ithaca Cambridge Annapolis New Haven.....
14 Buenos Ayres is a city of Spain Brazil Portugal Argentina.....
15 Ivory is obtained from elephants mines oysters reefs.....

16 Alfred Noyes is famous as a painter poet musician sculptor.....
17 The armadillo is a kind of ornamental shrub animal musical instrument dagger....
18 The tendon of Achilles is in the heel head shoulder abdomen.....
19 Crisco is a patent medicine disinfectant tooth-paste food product.....
20 An aspen is a machine fabric tree drink.....

21 The sabre is a kind of musket sword cannon pistol.....
22 The mimeograph is a kind of typewriter copying machine phonograph pencil.....
23 Maroon is a food fabric drink color.....
24 The clarionet is used in music stenography book-binding lithography.....
25 Denim is a dance food fabric drink.....

26 The author of "Huckleberry Finn" is Poe Mark Twain Stevenson Hawthorne.....
27 Faraday was most famous in literature war religion science.....
28 Air and gasolene are mixed in the accelerator carburetor gear case differential.....
29 The Brooklyn Nationals are called the Giants Orioles Superbas Indians.....
30 Pasteur is most famous in politics literature war science.....

31 Becky Sharp appears in Vanity Fair Romola The Christmas Carol Henry IV.....
32 The number of a Kaffir's legs is two four six eight.....
33 Habeas corpus is a term used in medicine law theology pedagogy.....
34 Ensilage is a term used in fishing athletics farming hunting.....
35 The forward pass is used in tennis hockey football golf.....

36 General Lee surrendered at Appomattox in 1812 1865 1886 1835.....
37 The watt is used in measuring wind power rainfall water power electricity.....
38 The Pierce Arrow car is made in Buffalo Detroit Toledo Flint.....
39 Napoleon defeated the Austrians at Friedland Wagram Waterloo Leipsic.....
40 An irregular four-sided figure is called a scholium triangle trapezium pentagon.....

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of the sentences below you have four choices for the last word. Only one of them is correct. In each sentence draw a line under the one of these four words which makes the truest sentence. If you cannot be sure, guess. The two samples are already marked as they should be —Ready—Go!"

After 4 minutes, say "Stop! Turn over the page to Test 1 again. In the upper right-hand corner, where it says 'Group No.—,' put the number 101" (or 102, 103, etc., according to the number of this group in the examiner's series of groups).

Directions for Scoring in Alpha Test.

GENERAL RULES

1. Each item is scored either right or wrong. No part credits are given.

2. In general, items evidently corrected stand as corrected.

3. In tests where the score is "Number Right," only wrong items need be checked in scoring. In Tests 4 and 5, where the score is "Right minus Wrong," wrong and omitted items must be separately checked.

4. Indicate the last item attempted by drawing a long line under that item and out into the margin.

5. Enter the score for each test in lower right-hand corner of the test page and encircle it. When the test has been re-scored, a check mark may be made beside the circle.

6. Red or blue pencil increases accuracy of scoring.

TEST 1

(Score is number right.)

1. No credit is given for any item in which *more* is done than the instructions require.

2. In an item where something is to be written "*in*" a given space, give credit if a mark crosses a line from haste or awkwardness: give no credit if the position is really ambiguous.

3. Where something is to be underlined or crossed out, give credit if two or three underlinings are made in the required place, and give credit for any method of crossing out.

4. *Item 2.*—The pencil line must begin and end either on the circumference or within the circles indicated. It may touch the intermediate circles, but must not cut through them.

5. *Item 6.*—In the circle marked "not 12" there must be some number which is not 12, such as 5, 0, 27.

6. *Item 9.*—The proper numbers must be crossed out to receive credit.

7. *Item 10.*—In Form 5, "2" alone and "3" alone, but not "2 or 3," in each

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of the two largest parts; "5" alone and "6" alone, but not "5 or 6," in the next to the smallest part, are correct. Similarly for other forms.

8. *Item 11.*—The lines must cross, or at least touch, the proper numbers; they may or may not cut the accompanying letters. Mere indication of the square, triangle, etc., is not sufficient.

9. *Item 12.*—Underlining in place of crossing out is wrong.

Test 2

(Score is number right.)

1. Answer may be written on dotted line or elsewhere near its problem.
2. If two answers are given to any problem count as wrong.
3. If it seems clear that, by a slip, one answer has been put in the wrong bracket, and the next answers are all thus misplaced, give credit for the answers that are right even if misplaced.
4. Omission of dollar sign is permissible.
5. Omission of decimal point is permissible in items, 2, 9, 13, and 14. Fraction may be expressed as decimal in item 15.

Test 3

(Score is number right.)

1. Any clear method of indicating answer is given full credit—underlining, checking, etc.
2. If two answers are marked, count as wrong unless one is clearly indicated as final.

Test 4

(Score is number right minus number wrong.)

1. Any clear method of indicating answer is given credit.
2. When both "Same" and "Opposite" are underlined, counts as *omitted*, not as wrong.
3. If only "Same" is underlined right down the column, score for the test is zero. Similarly if "Opposite" is underlined right down the column.

Test 5

(Score is number right minus number wrong.)

Same rules as for Test 4.

Test 6

(Score is number right.)

1. If only one number is written, give no credit.
2. If only one of the numbers is right, give no credit.

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3. If four numbers are written, as frequently happens with certain items (i. e., 33, 11 instead of 3, 3), give full credit.

Test 7

(Score is number right.)

1. Any clear indication other than underlining receives full credit.
2. Underlining of any of the first three words of an item does not remove credit.
3. If two or more of the last four words are marked, give no credit.

Test 8

(Score is number right.)

Same rules as for Test 7.

Total Score and Rating

The result of examination Alpha is expressed in a total score which is the sum of the raw scores of the several tests. The raw scores are obtained as follows:

Test	Method of scoring	Maximum raw score
1	R	12
2	R	20
3	R	16
4	R–W	40
5	R–W	24
6	R	20
7	R	40
8	R	40
Total		212

Letter ratings are assigned on examination Alpha as follows:

Rating	Score
A	185–212
B	105–184
C+	75–104
C	45–74
C—	25–44
D	15–24
D—[1]	0–14

[1]Recalled for further examination.

All ratings above "D—" are entered and reported at once. Men whose scores are below "D" are recalled for examination Beta. Ratings of "D—" may not be given in Alpha, unless recall of the men for Beta is impossible

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Method of Giving the Army Beta Tests.

In practice the Beta tests, reproduced in facsimile on pages 313 to 322 following, are given with the assistance of a blackboard chart on which the different tests are painted in white, so that the examiner can show them to the entire group before they see them on their examination papers. There are also required for giving the Beta tests a set of cardboard cubes for the examiner's use in explaining Test 2, and a set of cardboard pieces cut to the shapes of the figures in Test 7, though of much larger size. The assistance of a demonstrator is also required. *Procedure.*

It is most important that examination Beta be given in a genial manner. The subjects who take this examination sometimes sulk and refuse to work. E. and his assistants will find it necessary to fill out most of the headings for the men before the examination begins. The time required for this preparatory work may be used to advantage in making the men feel at ease. As the demonstration preparatory to each test requires some time, the "pencils up" command is omitted in examination Beta. The examiner's platform should be so high that he can readily see whether or not the subjects are working. Great care should be taken to prevent the overanxious from beginning work before the command "Go."

Seating conditions should be such that subjects cannot copy from one another and the rule that copying shall not be allowed should be enforced strictly. The blackboard should at all times be kept clean so that the visual conditions may be excellent and constant. The blackboard figures for Test 1 should be exposed when the subjects enter the examining room. *As soon as a test has been demonstrated and the men have been told to go ahead, the blackboard should be covered and kept covered until time is called.* It should not be turned to the next test until the men have been ordered to stop work on a given test. Care should be taken to have the physical conditions of examination reasonably uniform.

With the exception of the brief introductory statements and a few orders, instructions are to be given throughout by means of gestures instead of words. These gestures accompany the samples and demonstrations and should be animated and emphatic.

It is absolutely necessary that directions be followed closely and procedure kept uniform and definite. Variations of procedure are more likely to occur in Beta than in Alpha, and there is serious risk that if allowed they will lessen the value of results. E. should especially guard against using more or fewer gestures of words for one group than for another. Oral languages should be rigidly limited to the words and phrases given in the procedure for the different tests.

Whether the men get the idea of the test and enter into it with the proper spirit will depend chiefly on the skill with which the examiner, the demonstra-

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tor, and the orderlies carry out their respective parts. Examiner and demonstrator especially should be selected with the greatest care. An examiner who succeeds admirably in giving Alpha may prove to be entirely unadapted for Beta. Both examiner and demonstrator must be adept in the use of gesture language. In the selection of a demonstrator the Personnel Office should be consulted. One camp has had great success with a "window seller" as demonstrator. Actors should also be considered for the work. The orderlies should be able to keep the subjects at work without antagonizing them and to keep them encouraged without actually helping them.

The demonstrator should have the single task of doing before the group just what the group is later to do with the examination blanks. The blackboard is his Beta blank. Before examination Beta can be given satisfactorily the demonstrator must be letter perfect in his part. Both E. and demonstrator must be very careful to stand at the side of the blackboard in order not to hide the drawings.

As soon as the men of a group have been properly seated, pencils should be distributed and also examination blanks with Test 8 up. While this is being done E. should say "Here are some papers. You must not open them or turn them over until you are told to." Holding up Beta blank, E. continues:

"In the place where it says name, write your name; print it if you can. (Pause.) Fill out the rest of the blank about your age, schooling, etc., as well as you can. If you have any trouble we will help you" (The instructions given under segregation may be used for filling out the Beta blank). E. should announce the group number and see that it as well as the other necessary information is supplied. Before the examination proceeds each paper should be inspected in order to make sure that it is satisfactorily completed.

After the initial information has been obtained, E. makes the following introductory remarks:

"*Attention!* Watch *this* man (pointing to demonstrator). *He* (pointing to demonstrator again) is going to do *here* (tapping blackboard with pointer) what *you* (pointing to different members of group) are to do on your *papers* (here E. points to several papers that lie before men in the group, picks up one, holds it next to the blackboard, returns the paper, points to demonstrator and the blackboard in succession, then to the men and their papers). Ask *no questions*. *Wait* till I say 'Go ahead!'"

In general, when instructing the group to turn from test to test, E. holds up a Beta blank before group and follows his own instructions as he gives them. As soon as he has turned to desired test or page he says, "This is test X *here;* look!" (Pointing to the page.)

To suggest to the group the necessity of working rapidly the demonstrator, after proceeding very deliberately with the early samples of each test, hurries as soon as he has worked out the last sample problem.

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(1) to record his response as fast as he can,

(2) then to catch E.'s eyes for approval and

(3) finally, to slip away from blackboard, drawing curtain as he does so.

After the personal data called for on page 1 of blank have been gathered and recorded, the orderlies' vocabulary in Beta is rigidly restricted to the following words, or their literal equivalents in Italian, Russian, etc.: *Yes, No, Sure, Good, Quick, How many? Same, Fix it.* Under no circumstances may substitutional explanations or directions be given.

Test 1—Maze

"Now turn your papers over. This is Test 1 *here* (pointing to page of record blank). Look." After all have found the page, E. continues, "Don't make any marks till I say 'Go ahead.' Now *watch.*" After touching both arrows E. traces through first maze with pointer and then motions the demonstrator to go ahead. Demonstrator traces path through first maze *with crayon*, slowly and hesitatingly. E. then traces second maze and motions to demonstrator to go ahead. Demonstrator makes one mistake by going into the blind alley at upper left-hand corner of maze. E. apparently does not notice what demonstrator is doing until he crosses line at end of alley; then E. shakes his head vigorously, says "No—no," takes demonstrator's hand and traces back to the place where he may start right again. Demonstrator traces rest of maze so as to indicate an attempt at haste, hesitating only at ambiguous points. E. says "Good." Then, holding up blank, "Look here," and draws an imaginary line across the page from left to right for every maze on the page. Then, "All right. Go ahead. Do it (pointing to men and then to books). Hurry up." The idea of working fast must be impressed on the men during the maze test. E. and orderlies walk around the room, motioning to men who are not working, and saying, "Do it, do it, hurry up, quick."

At the end of 2 minutes E. says, "Stop! Turn over the page to Test 2."

Test 2—Cube Analysis

"This is Test 2 *here.* Look." After everyone has found the page—"Now watch." The order of procedure is as follows:

(1) E. points to the three-cube model on the blackboard, making a rotary movement of the pointer to embrace the entire picture.

(2) With similar motions he points to the three-cube model on shelf.

(3) E. points next to picture on blackboard and asks, "How many?"

(4) E. turns to cube model and counts aloud, putting up his fingers while so doing, and encouraging the men to count with him.

(5) E. taps each cube on the blackboard and motions to demonstrator, asking him "How many?"

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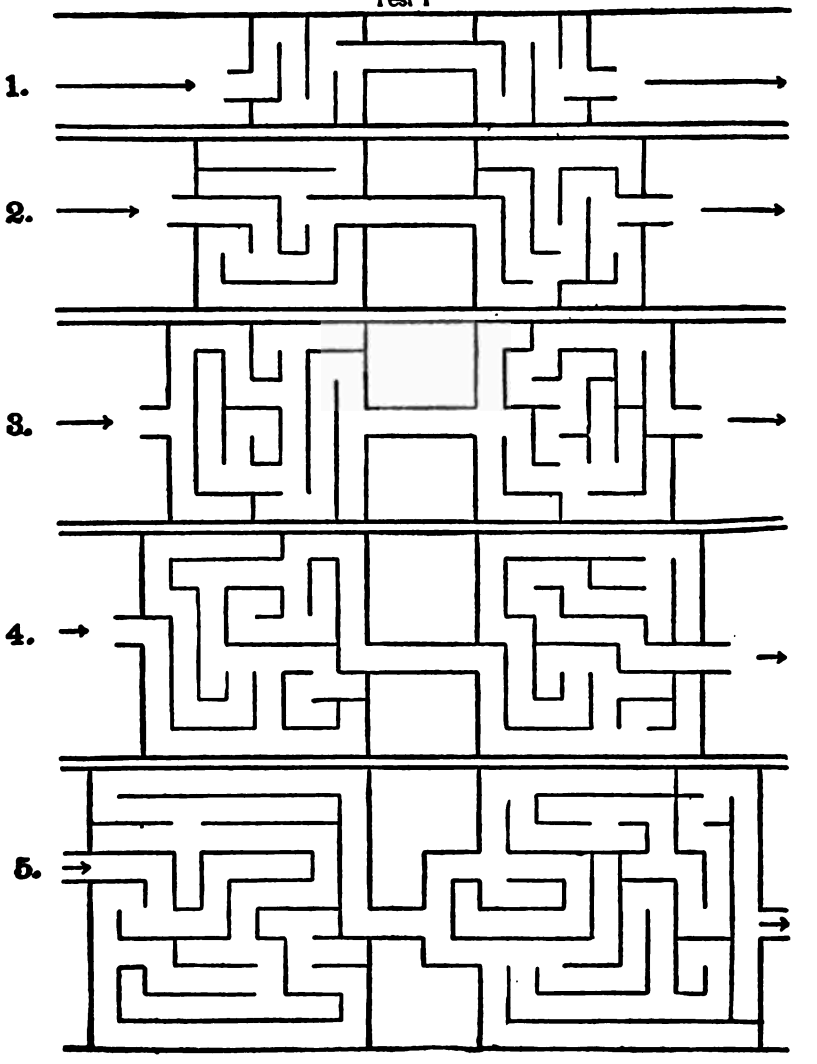
Test 1



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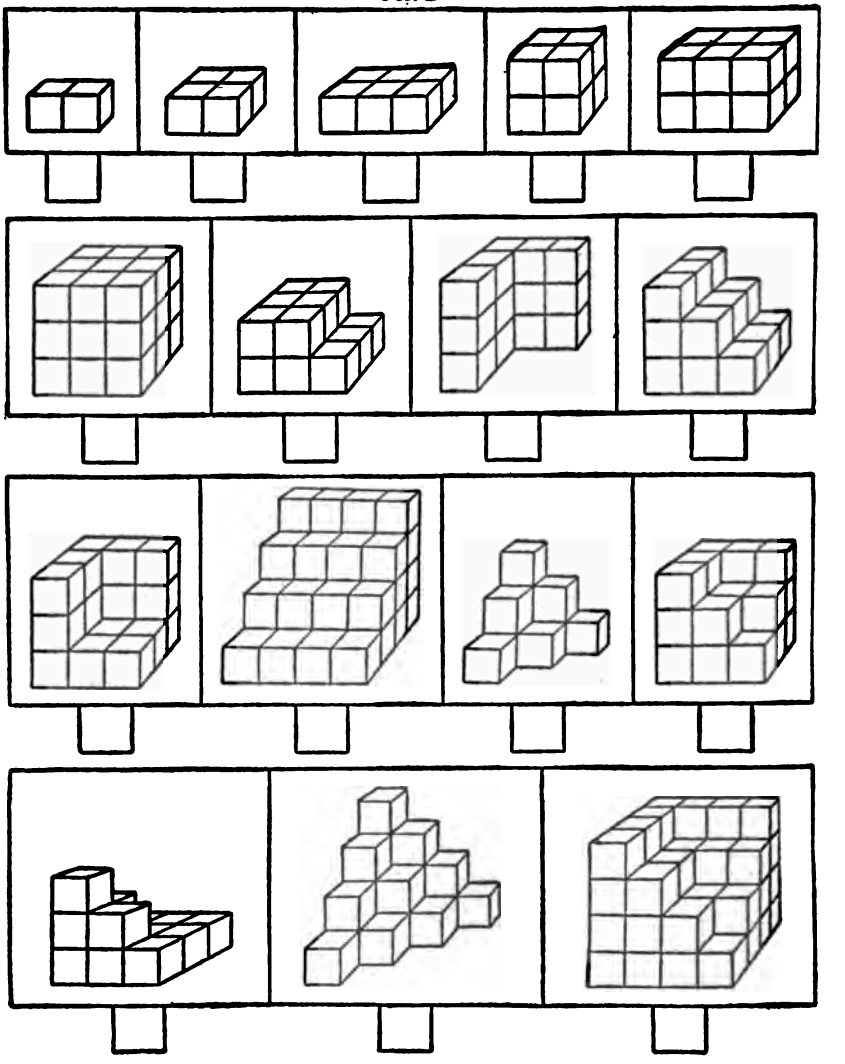
Test 2



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(6) Demonstrator (pointing) counts cubes on blackboard silently and writes the figure 3 in proper place.

In the second sample of this test, when E. counts cubes of model he

(1) counts the three exposed cubes;

(2) touches the unexposed cube with pointer; and

(3) without removing pointer turns model, so that hidden cube comes into view of group. In other respects procedure with second and third samples is the same as with first.

In counting the 12-cube model, E. (1) counts the top row of cubes in the model (left to right), (2) counts the exposed bottom row (right to left), (3) taps with pointer the end cube of hidden row, (4) turns the entire model around and completes his counting, E. then holds model in same place as drawing and counts (in the same order as above) the cubes on blackboard, counting lines between front and top row as representing the hidden row. He then asks demonstrator "How many?" Demonstrator counts the cubes on blackboard (pointing but not speaking) and writes the response.

Throughout the demonstration the counting is done deliberately, not more rapidly than one cube per second.

At end of demonstration E. points to page and says, "All right. Go ahead." At the end of 2½ minutes he says, "Stop! Look at me and don't turn the page."

Test 3—X-O Series

"This is Test 3 *here*. Look." After everyone has found the page—"Now watch." E. first points to the blank rectangles at the end, then traces each "O" in chart, then traces outline of "O's" in remaining spaces. Demonstrator, at a gesture, draws them in. E. then traces first "X" in next sample, moves to next "X" by tracing the arc of an imaginary semicircle joining the two, and in the same manner traces each "X," moving over an arc to the next. He then traces outlines of "X's" in the proper blank spaces, moving over the imaginary arc in each case, and motions to demonstrator to draw them in. Demonstrator, at a gesture, fills in remaining problems very slowly, standing well to the right of the blackboard and writing with his left hand. E. points to page and says, "All right! Go ahead. Hurry up!" At end of 1¾ minutes he says, "Stop! Turn over the page to Test 4."

Test 4—Digit—Symbol

"This is Test 4 *here*. Look." After everyone has found the page—"Now watch." E. points to first digit of key on blackboard and then points to the symbol under it. Same for all nine digits in key. E. then (1) points to first digit of sample, (2) to the empty space below digit, (3) points to corresponding digit of key, (4) points to proper symbol under digit in key, and (5) traces the

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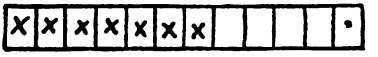
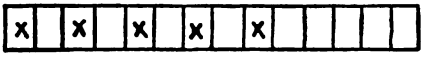
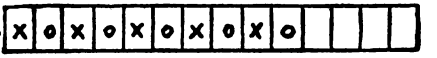
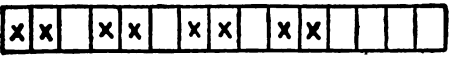
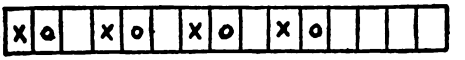
1. 

2. 

3. 

4. 

5. 

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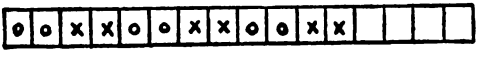
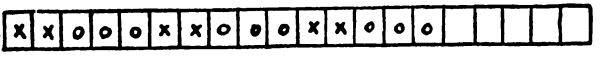
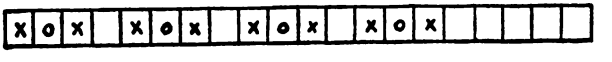
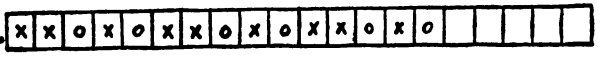
7. 

8. 

9. 

10. 

11.

12.

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Test 4

1	2	3	4	5	6	7	8	9
−	И	Ɔ	L	U	O	∧	X	=

1.

3	1	2	1	3	2	1	4	2	3	5	2	9	1	4

2.

6	3	1	5	4	2	7	6	3	8	7	2	9	5	4

3.

6	3	7	2	8	1	9	5	8	4	7	3	6	9	5

4.

1	9	2	8	3	7	4	6	5	9	4	8	5	7	6

5.

9	3	8	6	4	1	5	7	2	6	2	4	8	1	3

6

4	9	5	1	7	5	2	6	9	3	7	8	4	1	8

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outline of the proper symbol in the blank space under the digit in the sample. Same for first five samples. Demonstrator, at a gesture, fills in all the samples, working as follows: (1) Touches the number in first sample with index finger of right hand; (2) holding finger there, finds with index finger of left hand the corresponding number in key; (3) drops index finger of left hand to symbol for number found; (4) holding left hand in this position writes appropriate symbol in the lower half of sample.

Similarly with the other samples. While working, demonstrator should stand as far as possible to the left, doing all the samples from this side.

At the end of demonstration E. says, "Look here" and points to key on page, repeating the gestures used in pointing on the blackboard at the beginning of the demonstration. Then, "All right. Go ahead. Hurry up!" Orderlies point out key to men who are at a loss to find it. At the end of 2 minutes, E. says: "Stop! But don't turn the page."

Test 5.—Number Checking

"This is Test 5 *here*." After everyone has found the page, "Now watch." In this demonstration E. must try to get "Yes" or "No" responses from the group. If the wrong response is volunteered by group, E. points to digits again and gives right response, "Yes" or "No" as the case may be. E. points to first digit of first number in left column, then to first digit first number in right column, then to second digit first number in left column and second digit first number in right column; nods head, says "Yes" and makes an imaginary cross at end of number in right column. Motions to demonstrator, who makes an "X" there. E. does the same for second line of figures, but here he indicates clearly by shaking head and saying "no" that certain digits are not identical. E. repeats for three more sets and after each, looks at group, says "Yes?" in questioning tone and waits for them to say "Yes" or "No." He repeats correct reply with satisfaction. Demonstrator checks each after group has responded, or at signal from E. if group does not respond. Demonstrator then works out remaining items, pointing from column to column and working deliberately. E. summarizes demonstrator's work by pointing to the whole numbers in each set and saying "Yes" (indicating X) or "No"; if "No," he shows again where the numbers are unlike. E. then points to page and says "All right. Go ahead. Hurry up!" At the end of 3 minutes E. says "Stop! Turn over the page to Test 6."

Test 6.—Pictoral Completion

"This is Test 6 *here*. Look. A lot of pictures." After everyone has found the page, "Now watch." E. points to hand and says to demonstrator: "Fix it." Demonstrator does nothing, but looks puzzled. E. points to the picture

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Test 5

650	.....	650	10248586	.....	10248586
041	.....	044	659012584	.....	659021584
2579	.....	2579	381872902	.....	381872902
3281	.....	3281	681027594	.....	681027594
55190	.....	55102	2499901584	.....	2499901584
39190	.....	39190	2261059810	.....	2261659810
658049	.....	650849	2911088227	.....	2911088227
3295017	.....	3290517	818577752	.....	818577752
68015991	.....	68019991	1012988567	.....	1012988567
89007106	.....	89007106	7162220988	.....	7162220988
69981087	.....	69981087	8177682449	.....	8177682449
251004818	.....	251004418	468672668	.....	468672668
299056018	.....	299056018	9104529008	.....	9194529008
86015992	.....	860155992	8484657120	.....	8484657210
8910066482	.....	891006482	8588172556	.....	8581722556
8510278801	.....	8510278801	8120166671	.....	8120166671
263186996	.....	263186996	76111848879	.....	76111845879
451152908	.....	451152908	26557289164	.....	26557289164
8259016275	.....	8295016725	8819002841	.....	8819002841
582089144	.....	582089144	6571018084	.....	6571018084
81558529	.....	61588529	88779762514	.....	88779765214
211915888	.....	211915888	89008126557	.....	89008126657
670418822	.....	670148822	75658100898	.....	75658100898
17198591	.....	17198591	41181900726	.....	41181900726
86482991	.....	86482991	6548920817	.....	6548920871

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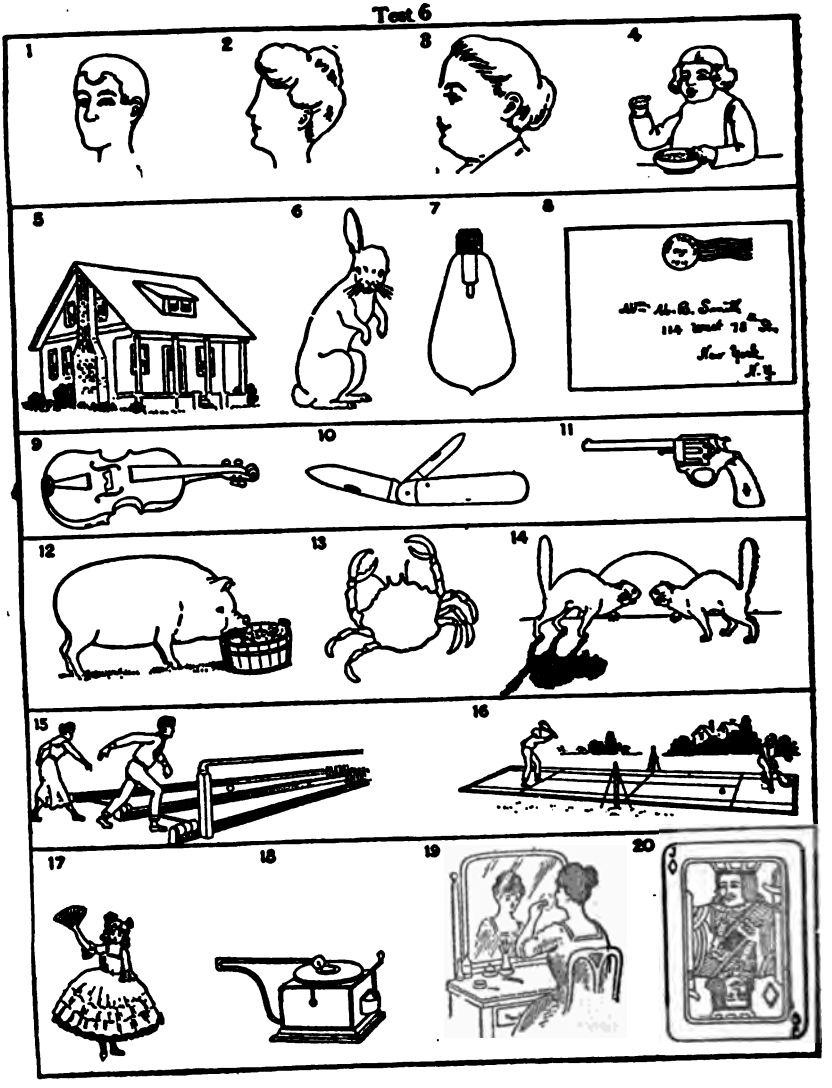
Test 6



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of the hand, then to the place where finger is missing and says to demonstrator: "Fix it. Fix it." Demonstrator then draws in finger. E. says, "That's right." E. then points to fish and place for eye and says, "Fix it." After demonstrator has drawn missing eye, E. points to each of the four remaining drawings and says, "Fix them all." Demonstrator works samples out slowly and with apparent effort. When the samples are finished E. says, "All right. Go ahead. Hurry up!" During the course of this test the orderlies walk around the room and locate individuals who are doing nothing, point to their pages, and say "Fix it. Fix them," trying to set everyone working. At end of 3 minutes E. says, "Stop! But don't turn over the page."

Test 7.—Geometrical Construction

"This is Test 7 *here*. Look." After everyone has found the page, "Now watch." Examiner points to the first figure on blackboard. He then takes the two pieces of cardboard, fits them on to the similar drawings on blackboard to show that they correspond and puts them together in the square on blackboard to show that they fill it. Then, after running his finger over the line of intersection of the parts, E. removes the pieces and signals demonstrator, who draws solution in the square on blackboard. The same procedure is repeated for the second and third sample. Demonstrator works out fourth sample, after much study, pointing from the square to the forms.

Demonstrator first draws the two small squares in the upper half of the large square, then the two triangles in the remaining rectangle. Each small figure is drawn in by tracing its entire circumference, not merely the necessary dividing lines. While drawing each small figure in the large square, demonstrator points with index finger of left hand to the corresponding small figure at left of square, taking care not to obstruct the view. At end of demonstration E. holds up blank, points to each square on the page and says, "All right. Go ahead. Hurry up!" At end of 2½ minutes, "Stop! Turn over the page." Papers are then collected immediately.

Scoring the Beta Tests.

General Rules

1. In general, items evidently corrected stand as corrected. The only exception to this rule is in the maze test.

2. In tests where the score is number right, only wrong items need be checked in scoring. In Test 5, where the score is right minus wrong, wrong and omitted items must be separately checked.

3. Enter the score for each test in lower right-hand corner of the test page and

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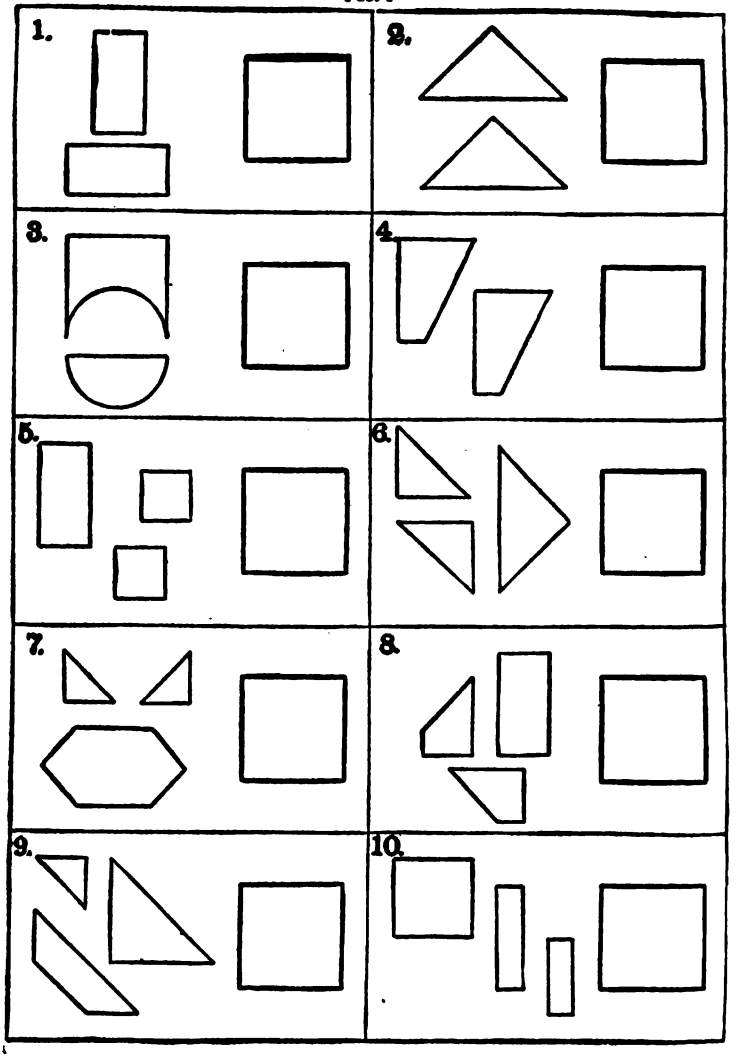
Test 7



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encircle it. When the test has been rescored a check may be made beside the circle.

4. Red or blue pencil increases accuracy of scoring.

TEST 1.

1. One half point for each correctly completed half of maze. A half maze is correct if drawn line does not cross any line of maze (except through awkwardness) nor an imaginary straight line across the opening of a wrong passage.

2. Allow much leeway in the cutting of corners.

3. Spur running into any blind passage counts wrong for that half-item, even though erased.

4. When two lines are drawn, one straight across the page, the other correct, full credit is given.

TEST 2.

Score is number right.

TEST 3.

1. Score is number right.

2. Any incomplete item receives no credit.

3. Count any item correct if intended plan is carried out. Disregard additional unnecessary marks, such as circles between the crosses of items 2 and 4 in first part of line, etc.

TEST 4.

1. Score is one third of number of correct symbols.

2. Use leniency in judging form of symbol.

3. Credit symbol for 2 even though reversed.

TEST 5.

1. Score is right minus wrong (number of items checked that should be checked minus number of items checked that should not be checked).

2. If other clear indication is used instead of crosses, give credit.

3. If numbers which should not be checked are marked by some other sign than is used to check similar pairs, count as though not marked.

4. If all items are checked, the score for the test is zero.

TEST 6.

1. Score is number right.

2. Allow much awkwardness in drawing. Writing in name of missing part or any way of indicating it receives credit, if idea is clear.

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3. Additional parts do not make item wrong, if proper missing part is also inserted.

4. Rules for individual items:

Item 4.—Any spoon at any angle *in right hand* receives credit. Left hand, or unattached spoon, no credit.

Item 5.—Chimney must be in right place. No credit for smoke.

Item 6.—Another ear on same side as first receives no credit.

Item 8.—Plain square, cross, etc., in proper location for stamp, receives credit.

Item 10.—Missing part is the rivet. Line of "ear" may be omitted.

Item 13.—Missing part is leg.

Item 15.—Ball should be drawn in hand of man. If represented in hand of woman, or in motion, no credit.

Item 16.—Single line indicating net receives credit.

Item 18.—Any representation intended for horn, pointing in any direction, receives credit.

Item 19.—Hand and powder puff must be put on proper side.

Item 20.—Diamond is the missing part. Failure to complete hilt on sword is not an error.

Test 7.

1. Score is number right.
2. Allow considerable awkwardness in drawing.
3. Extra subdivisions, if not erased, make item wrong.
4. Rules for individual items:

Item 1.—Line of division may be slightly distant from true centre, and need not be straight.

Item 3.—Lines of semi-circumference must start from or near corners of square.

Item 4.—Line must not start from corner.

4. Total Score and Rating

The result of examination Beta is expressed as a "total score," which is the sum of the raw scores of the several tests. The raw scores are obtained as follows:

Test	Method of scoring	Maximum score
1	Half point for each half maze	5
2	Number right	16
3	Number right	12
4	One third of number right	30
5	Right minus wrong	25
6	Number right	20
7	Number right	10
Total		118

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Letter ratings are assigned on examination Beta as follows:

RATING	SCORES
A	100–118
B	90– 99
C+	80– 89
C	65– 79
C—	45– 64
D	20– 44
D[1]	0– 19

[1]Recalled for individual examination.

All ratings above D— are entered and reported at once. Men whose scores fall below D are recalled for individual examination.

Ratings of D— may not be given in examination Beta, unless recall of the men for individual examination is impossible.

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APPENDIX C

Method of Calculating the Coefficient of Coördination

(See Pages 95–97)

A simple method of determining precisely the degree to which the mental test of 28 school children reflects or is related to their scholarship records and the teacher's estimate, as shown in the table on Page 96, is to plot the relationship graphically, which has been done in the accompanying diagrams.

In each diagram a heavy diagonal line shows approximately where the plotted points would fall if the relationship were perfect between the numbers of errors in the educational measurements and the other measure of ability. It is clear that the relationship shown in each diagram is far from perfect, but it is not clear from the diagrams which rating of the teacher is most nearly approximated by the educational measurement scores. To discover this relative degree of relationship, a mathematical calculation must be made. For the purposes of testing the correspondence between the scores in the various Mentimeter tests and the production records or supervisor's ratings of the group of persons tested, it is sufficient to calculate what is best called "a coefficient of coördination."*

The first step in the calculation of a coefficient of coördination is the transformation of the original scores into figures indicating order of merit. In the case of the sixth-grade class here referred to, the teacher's ratings of intelligence need not be changed, for they are exactly the kind of ratings necessary: 1 indicating the brightest and 28 the dullest pupil, so far as the teacher was able to judge her pupils at the end of a year's work. Since the educational measurements scores reported are the number of errors made by each child, the rank of the child making the smallest numbers of errors will be 1, while the rank of the pupil making the largest number of errors will be 28. On the other hand, the scholarship marks are the summaries of the teacher's percentage marks for a half year, hence the best pupil is the one making the highest percentage. In scholarship, then, the highest percentage should get the rank of 1 and the lowest percentage a rank of 28.

*Calculated by a somewhat more complex formula, approximately the same measure of relationship might be found, called by the more familar name "coefficient of correlation."

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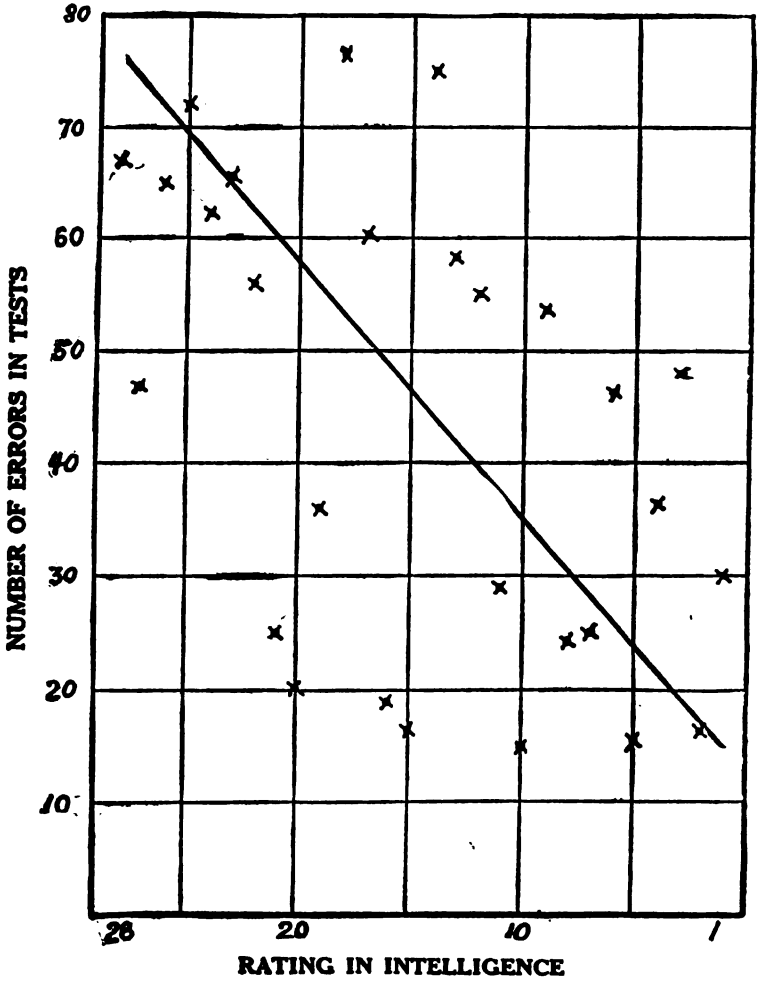
Graphic picture of relation between test results and intelligence ratings given by teacher



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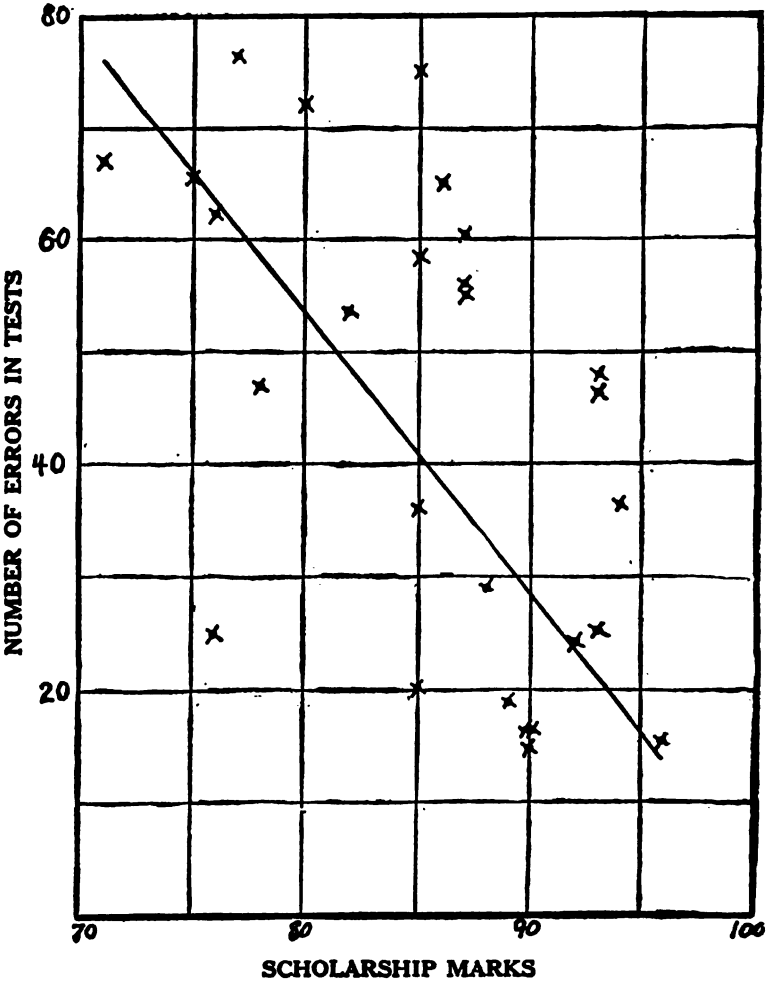
Graphic picture of relation between test results and scholarship marks given by teacher



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The first three columns of the following table give ranks in the place of the original figures which indicated numbers of errors in measurements and percentage in scholarship. Where two or more individuals are entitled to the same rank, the figure used is the middle value of the ranks. Thus in the case of the educational measurements scores, two girls made 16.5 errors. There are but two

RANKING OF SIXTH-GRADE PUPILS				DIFFERENCES IN RANKINGS					
				A to B		A to C		B to C	
Name of Pupil	A Educational Measurements	B Teacher's Ranking	C Scholarship Marks	d	d^2	d	d^2	d	d^2
Adelaide	12	19	18.5	7.	49.	6.5	42.25	0.5	0.25
Ruth	3.5	15	9.	11.5	132.25	5.5	30.25	6.	36.
Alexander	9	7	5	— 2.	4.	— 4.	16.	2.	4.
LaMonte	14	6	5	— 8.	64.	— 9	81.	1.	1.
Earl	28	18	24	—10.	100.	— 4.	16.	— 6.	36.
Joseph	6	20	18.5	14.	196.	12.5	156.25	1.5	2.25
Amedeo	27	14	18.5	—13.	169.	8.5	72.25	4.5	20.25
Leo	16	3	5	—13.	169.	—11.	121.	— 2.	4.
William	17	9	21	—8.	64.	4.	16.	—12.	144.
Isabel	8	21	25	13.	169.	17.	289.	— 4.	16.
Ida	13	4	3	— 9.	81.	—10.	100.	1.	1.
Hazel	1	10	9	9.	81.	8.	64.	1.	1.
Frederick	23	26	16	3.	9.	— 7.	49.	10.	100.
Charles	20	13	18.5	— 7.	49.	— 1.5	2.25	5.5	30.25
Edward	11	1	2	—10.	100.	— 9.	81.	— 1.	1.
Benjamin	22	24	26	2.	4.	4.	16.	— 2.	4.
Bruce	19	22	14	3.	9.	— 5.	25.	8.	64.
Alden	18	12	14	— 6.	36.	— 4.	16.	— 2.	4.
George	21	17	14	— 4.	16.	7.	49.	3.	9.
Alice	10	11	12	1.	1.	2.	4.	— 1.	1.
Almira	2	5	1	3	9.	— 1.	1	4.	16.
Helen	3.5	2	9	— 1.5	2.25	5.5	30.25	— 7.	49.
Elisabeth	24	23	27	— 1.	1.	3.	9.	— 4.	16.
Amelia	7	8	7	1.	1.	0	0	1.	1.
Edwin	5	16	11	11.	121.	6.	36.	5.	25.
Robert	25	28	28	3.	9.	3.	9.	0	0
Edna	15	27	23	12.	144.	8.	64.	4.	16.0
Samuel	26	25	22	— 1.	1.	— 4.	16.	3.	9.
				$\Sigma d^2 =$	1790.5		1411.5		611.0

pupils making better showings, and therefore Ruth and Helen would normally rank third and fourth, but since we have no evidence as to which should rank third and which fourth, each is given a rank of 3.5. Similarly it will be observed that Alexander, LaMonte, and Leo each obtained a percentage of 93 in scholarship, therefore the three boys named share equally the fourth, fifth, and sixth rank, each being given 5 as a rank; and the next highest pupil, Amelia with a percentage of 92, is given 7 as a rank.

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The coefficient of coördination, being an index number to show the closeness with which two rankings correspond, is dependent upon the differences between the rankings of the various individuals in the two measures being compared. The formula used is $\rho = \frac{6\,\Sigma d^2}{n(n^2-1)}$, where ρ stands for the coefficient of coördination, d stands for the difference between an individual's rank in the two measures, and n stands for the number of individuals ranked in the two traits. The capital sigma, Σ, stands for the sum of whatever follows it, in this case the squares of the differences between the two rankings.

We may now employ the formula to find the coefficient of coördination between rank in educational measurements and rank in the teacher's judgment as to intelligence. The difference between the ranks in column A and column B of the above table is given in the fourth column. Adelaide had a 12 in column A and a 19 in column B, so the difference (7) appears in the fourth column and its square (49) in the fifth column. Similarly the difference between Ruth's 3.5 and her 15 is 11.5, the square of which is 132.25. Finding the squares of all the differences between rank in A and rank in B, and adding these squares together at the bottom of the table gives 1790.5, which may now be substituted in the formula for $\Sigma\ d^2$. n, the number of pupils is in this case 28, and therefore $n\ (n^2 - 1)$ is 28 (28 squared less 1) = 28 (784 — 1) = 28 x 783 = 21924. The substitution in the formula then goes as follows;

$$\rho = 1 - \frac{6\,\Sigma\,d^2}{n\,(n^2-1)} = 1 - \frac{6 \times 1790.5}{28 \times 783} = 1 - \frac{10743.}{21924.} = 1 - .490 = .510$$

The coefficient of coördination between rank in the educational measurements and rank in the teacher's estimate of intelligence for the sixth grade class is .51, which suggests the question of how to interpret a coefficient after it is found.

A coefficient of 1.00 would mean perfect coördination and would only be found when there were no differences whatever between the two rankings considered. Such a perfect relationship will probably never be found, except by some freak of chance, for even when a group of persons is retested with the same test there is almost certain to be some change in their relative standings. A coefficient of 0.00 would indicate no relation whatever between the two rankings, while a coefficient of — 1.00 would mean perfect correlation of a negative sort, the person getting highest in one measure getting lowest in the other, the person scoring next to the highest in one scoring next to the lowest in the other, and so on. Perfect negative correlation is as infrequent as perfect positive correlation.

The coefficient found between the teacher's estimates of intelligence and the results of educational measurements, .51, indicates a really useful degree of coördination. Unless a Mentimeter test shows a coefficient of coördination of .25 or more with the production records (or other reliable measure of true ability), it may be considered as having little value in helping to select and differentiate men for that particular line of work. If the coefficient is above .5, the test is

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quite useful, and the nearer the coefficient approaches 1.00 the more confidence one may place in the test as a means of selecting and classifying men in that particular field.

The sixth column of the table on page 8 gives the difference between the test results rankings and the scholarship marks rankings, and the seventh column gives the squares of these differences, the sum of these squares being given at the bottom of the seventh column as 1411.5. By substituting in the formula,

$$\rho = 1 - \frac{6 \Sigma d^2}{n (n^2-1)} = 1 - \frac{6 \times 1411.5}{28 \times 783} = 1 - \frac{8469.}{21924.} = 1 - .386 = .614,$$

it appears that the tests more closely correspond with the average of the scholarship marks given by the teacher than with the teacher's estimate of intelligence. This is partly to be explained by the fact that the tests given were measurements of ability in school subjects rather than tests of intelligence, and still more by the fact that the teacher gave scholarship marks on the basis of relatively objective examinations while her estimates of intelligence are always wholly subjective.

The eighth and ninth columns on page 8 give the differences between the ranks in the teacher's estimates of intelligence and the ranks in the scholarship marks given during a half year. The coefficient of coördination worked out from these differences is .833 ($\rho = 1 - \frac{6 \times 611}{28 \times 783} = 1 - \frac{3666}{21924} = 1 - .167 = .833$) which would seem to indicate that the teacher drew very heavily on her knowledge of the relative scholarship of her pupils in making her estimates of their intellectual capacities.

The three coefficients worked out above for 28 pupils in a sixth grade are typical of the mathematical relationships the reader will wish to work out between known degrees of ability in a certain type of work and the results of the Mentimeter tests. The coefficients of coördination for the sixth-grade pupils studied above are, between

Educational Measurements and Estimated intelligence	= .51
Educational Measurements and Scholarship Averages	= .61
Estimated Intelligence and Scholarship Averages	= .83

No method of forecasting degree of success in one line of work from quality of performance in another task (or in a test) will give a perfect coefficient of coördination of 1.00, but the nearer the coefficient approaches 1.00 the more reliance one may put in the test which furnishes such a ranking of the individuals.

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APPENDIX D

Correct Answer for Mentimeter Tests

The advantages of a carefully standardized test over an ordinary examination which any one might prepare for his own use are chiefly the characteristics implied in the word "standard." A standard test is one which has been carefully prepared after extensive experience with similar tests; one which is made exact and objective by the most minute specifications as to how it shall be applied, marked, scored, and interpreted; and one on which many persons of varying degrees of proved ability have been tested and reported, for comparison with the results to be obtained later from testing other persons of undetermined degrees of ability. The purpose of this section of the appendix is to make definite and unmistakable the answers to the questions asked in the Mentimeter tests, in order that each reader may mark and interpret the results of these tests in exactly the same way, that is, in the "standard" way.

As was stated in the body of the discussion, each package of test booklets sold is accompanied by a "stencil" which fits over the pages of the printed test in such a manner as to bring the correct answer directly alongside the answer checked or written by the candidate examined, with the result that there is small opportunity for errors in the judgment of the persons making the answers. If the word checked or written corresponds with the word or words printed on the stencil at that point, the question has been answered correctly, while if the word checked or written by the candidate is less applicable than the one appearing on the stencil, the response is to be marked incorrect. With the aid of the stencils the Mentimeter tests may be marked correctly by inexpensive clerical assistants in from one third to one tenth of the time that would be required for the same work by the most intelligent men working without the stencils.

No attempt has been made to print here an exhaustive list of correct answers to each question. The answers printed as correct are merely typical in most cases of the quality of replies that should be accepted. Anything as appropriate as or more appropriate than the printed answer may be given full credit, while anything less satisfactory is to be given no credit at all. To print here all of the correct answers to each question would take more pages than can be allowed for this section of the Appendix and would in many cases cause more confusion than clearness of thought. It is suggested that any question of right or wrong answers which is difficult to decide should be settled arbitrarily by the

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reader and that a note be kept of just how the matter was decided, in order that any later investigator may have the benefit of his judgment. In some of the tests new solutions will continually be appearing, even after it seems certain that all of the correct answers have been found and catalogued.

MENTIMETER NO. 1: Typical Performances of Young Children.

Success in this test is measured by performances in response to *situations* created by the examiner to a much greater degree than by answers to *questions* asked by the examiner. The directions themselves give the answers in most cases, and in the other cases the correct answers depend upon such facts as the name or sex of the individual being tested. No set of answers is printed here for these tests, therefore, since to do so would be to reprint exactly the directions appearing on pages 115 to 128, which the reader should consult carefully and even commit to memory before undertaking to apply the tests to any infants or young children.

MENTIMETER NO. 2: Pictorial Absurdities.

In order to receive credit the check mark on each picture should be placed in such a way as to indicate unmistakably the part of the picture which is incorrect—in such a way as to leave no doubt whatever as to the candidate's having found and identified the incongruous element. The following are the elements that should be checked in each picture:

1. The front leg or foot.
2. The lower spout on the water pitcher.
3. The mouth on the forehead.
4. The horns (either one may be checked) on the horse's head.
5. The candle on the right arm of the electric fixture.
6. The rat's ears.
7. Either end of the spy-glass.
8. The next window to the rear on the third floor.
9. The postage stamp.
10. The sock used as a necktie.
11. The long stem of the lowest leaf.
12. The flag (flying in the opposite direction from the smoke and weather vane).
13. Either of the lights on the Ford.
14. The left front foot.
15. The man between first and second base (third man from the right).
16. The space between 4 and 5.
17. The claw hammer with which the man is driving the spike.
18. Either of the five fingers of the right hand.
19. The driver (facing the tail).

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20. The ball being played by the man at the right.
21. The incandescent electric bulb.
22. Either of the roller skates.
23. The knife in the man's right hand.
24. Either of the counterbalance weights on the drivewheels.

MENTIMETER NO. 3: `Maze Threading.

No list of correct answers can be printed for this test. The stencil provided with the test blanks shows exactly what the correct and most economical threading of each maze is, but the reader can find this solution for himself if he will take the time and make the effort. No credit should be given for any maze not completely traced or for any maze in which a printed line has been crossed. A candidate who has gotten into a "blind alley" but has retraced his way and ultimately been successful in getting through the maze should have full credit for that particular maze.

MENTIMETER NO. 4: Dot Pattern Correction.

Here again, the only way of giving the correct solution of each problem is by means of the transparent stencil furnished with each package of test blanks. That dot which can be "cut out" and still leave a perfectly symmetrical figure is the one which should be circled in each pattern. This is frequently at the very centre of the pattern, although the centre is not the correct one if by removing it the pattern is left unsymmetrical.

MENTIMETER NO. 5: Dividing Geometric Figures.

Only a transparent stencil can give a clear impression of the correct solution of each figure. In dividing a circle into two equal parts it makes no difference in what direction the diameter is run—in other words, any correct solution should be accepted and given full credit.

MENTIMETER NO. 6: Completion of Form-Series.

Only the stencil supplied with the test blanks can represent adequately the correct completion of each series. No credit is given in a series unless each blank is correctly filled.

MENTIMETER NO. 7: Checking Identity of Numbers.

1. Same
2. Different
3. Different
4. Different
5. Same
6. Different
7. Same
8. Same
9. Different
10. Same

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11. Different
12. Same
13. Different
14. Different
15. Same

16. Different
17. Different
18. Different
19. Same
20. Different

21. Different
22. Same
23. Same
24. Same
25. Same

26. Different
27. Same
28. Same
29. Different
30. Same

MENTIMETER NO. 8: Digit Symbol Substitution.

The reader may, by reference to the Key printed at the top of the test sheet, determine for himself the correctness of any symbol written by a candidate. The stencil furnished with the Test Blanks makes it possible for one to score this test very accurately with a very small expenditure of time and effort. In scoring this test with the stencil the correctness of the entire list of 100 characters can be checked in less than a minute by an ordinary clerk.

MENTIMETER NO. 9: Completion of Number Relation Series.

No credit is to be given on any line unless all of the missing numbers are correctly supplied. The score is the number of *lines* completed correctly in every detail.

—	—	—	—	—	6	—	—	—	—	Series 1
—	—	14	—	—	20	—	—	—	—	Series 2
—	—	—	9	—	—	6	5	—	—	Series 3
—	—	5	—	—	—	—	—	—	19	Series 4
41	—	—	—	—	—	—	27	—	—	Series 5
—	—	—	10	—	—	—	—	—	49	Series 6
—	—	—	½	—	—	1	—	4	—	Series 7
—	—	22	—	—	—	50	—	—	—	Series 8
—	11	—	—	—	—	25	—	—	—	Series 9
—	10	—	—	14	—	—	—	—	10	Series 10
—	8	—	—	—	—	16	17	19	—	Series 11
1	—	—	—	—	36	49	—	—	—	Series 12
2	—	—	—	—	34	37	74	—	—	Series 13
—	33	30	31	—	—	—	—	24	—	Series 14
—	—	—	15	16	16	—	—	—	6	Series 15
—	—	51	48	—	—	45	—	—	51	Series 16

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MENTIMETER NO. 10: Addition Tests

Test A: Addition Knowledge or Power.

1.	5	*7.*	142
2.	8	*8.*	248
3.	17	*9.*	1397
4.	79	*10.*	1664
5.	56	*11.*	5571
6.	88	*12.*	50362547

Test B: Addition Speed

1.	6	*21.*	13	*41.*	11
2.	17	*22.*	7	*42.*	14
3.	6	*23.*	8	*43.*	11
4.	11	*24.*	13	*44.*	11
5.	6	*25.*	14	*45.*	16
6.	11	*26.*	6	*46.*	11
7	3	*27.*	11	*47.*	15
8	9	*28.*	8	*48.*	12
9.	15	*29.*	12	*49.*	9
10.	10	*30.*	13	*50.*	14
11.	13	*31.*	15	*51.*	4
12.	7	*32.*	18	*52.*	9
13.	10	*33.*	5	*53.*	5
14.	7	*34.*	13	*54.*	17
15.	3	*35.*	13	*55.*	11
16.	5	*36.*	14	*56.*	7
17.	16	*37.*	10	*57.*	7
18.	4	*38.*	15	*58.*	9
19.	12	*39.*	15	*59.*	13
20.	11	*40.*	12	*60.*	12

MENTIMETER NO. 11: Memory for Numbers.

1.	56	*9.*	268359
2.	27	*10.*	635927
3.	935	*11.*	9583624
4.	416	*12.*	8195263
5.	7493	*13.*	35268349
6.	4857	*14.*	28593614
7.	95738	*15.*	639481725
8.	68124	*16.*	714963528

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MENTIMETER NO. 12: Repeating Numbers Backward.

1.	85	*7.*	35291
2.	46	*8.*	69824
3.	253	*9.*	752638
4.	948	*10.*	746951
5.	4937	*11.*	4857362
6.	8625	*12.*	5746283

MENTIMETER NO. 13: Memory for Sentences.

1. It snows in the winter.
2. Men usually have more dignity than boys.
3. There is no excuse for being thoughtless about the rights of other people.
4. The price of peace may sometimes be much greater than a nation can afford to pay.
5. It is unfortunate that war should ever be necessary among civilized nations.
6. Their harbour is a shallow body of water, connected with, but protected from, the open sea.
7. Conscience asserting itself as the voice divine within the human soul is nothing less than a real actuality.
8. Each state appoints a number of electors equal to the whole number of senators and representatives.
9. These discoveries—gunpowder, printing-press, compass, and telescope—were the weapons before which the old science trembled.
10. The use of italic type is indicated in the author's manuscript by underscoring the letters, words, phrases, or sentences that are to be italicized.

MENTIMETER NO. 14: Speaking Vocabulary Test.

Any explanation, which demonstrates conclusively that the candidate knows the nature and use of the word or object mentioned by the examiner, should be accepted and given credit, regardless of the logical or grammatical form of the statements. The explanatory words and phrases given below are not intended to serve as logical definitions or as exhaustive explanations, but merely to indicate the various types of thing that a given word might signify. In examining very intelligent adults, meanings not listed below but nevertheless correct and appropriate may be encountered. If any standard dictionary lists as authentic the meaning given by a candidate, it should be accepted without challenge. Repetitions by the candidate of the word to be explained should not be accepted as an explanation. For example, "buy" is not explained by "Buy is when you buy

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something." An explanation, to be satisfactory, should be in terms entirely different from the thing to be explained, although explanations otherwise quite simple are acceptable here.

1. An article of clothing, a covering or something to wear.
2. Obtaining possession or rights in an object in exchange for a price or other consideration.
3. Written or printed matter, usually bound in covers for convenience in reading.
4. A supply of goods or a place where such goods are kept. To lay away or deposit such supplies.
5. A musical instrument or term.
6. To have or gain temporary possession or rights, in return for some price or favour. The price paid for such rights. An opening or torn place, especially in cloth.
7. The flesh of cattle, especially when used as food.
8. A custom or rule established by a legislature or governing authority, or by the nature of the facts concerned.
9. A malady, illness, or infirmity, frequently accompanied by pain or weakness.
10. Uncertainty or hesitation in belief; dread, fear, distrust, or suspicion.
11. An officer who decides disputes or acts as umpire. To decide, pass judgment, or compare the relative merits of ideas, opinions, or objects.
12. The coming or occurrence of something considered desirable but not foreseen as certain. Lucky.
13. One who attends to letters, papers, or business matters for another individual or group of individuals. A writing desk.
14. Kingly or magnificent. Characteristic of or related to a king or ruler.
15. A watercourse or channel, usually artificial. A tube or duct.
16. An eager desire or longing, usually of a selfish nature.
17. A person of fair hair, skin, and eyes. Light coloured.
18. Property or possessions having money value. Riches. Goods.
19. To allow, let, authorize, or give consent. A license or permission.
20. Sagacity, knowledge, discretion. Ability to judge or discern, especially in matters of conduct.
21. To direct or control action. To manage, supervise, or exercise authority.
22. Authority or permission to do or act. Excess of freedom or abuse of liberty. To authorize or grant permission.
23. To strive for the same prize or object. To contend in rivalry.
24. The largest of the planets. A Roman god.
25. Humility, self-control, diffidence. Proper delicacy and propriety about self and actions.
26. A scheme or plan to be followed. Procedure based on material interest

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rather than on higher principles. A certificate of insurance or of money due under certain conditions.

27. The act or instrument used in determining the exact degree or quantity of a thing. The unit of amount. A division or part of a tune or other object. To determine degree or quantity.
28. Inspiration, ecstasy, emotion, eagerness, or the object of such manifestations.
29. Rate of interest, commission, or discount. Number of parts concerned in a hundred.
30. A measure of distance or area. An agreement between two parties for accomplishing a common task. To combine for mutual support.
31. A theory or system of social reorganization. Social reform through political agencies. A theoretically ideal society or state.
32. The science of exact reasoning. The laws or method of abstract thought. A treatise on thinking or reasoning.
33. To regard with reverence, respect, or veneration. To adore.
34. Satire, ridicule, contemptuous remarks, bitter taunts.
35. Sarcastic reproach, invective. To deride, revile, or reproach with insulting words.
36. Not transparent, dark, impervious to rays of light. Unintelligible, stupid.
37. One making a first appearance in society or before the public.
38. Act of repairing or restoring. Giving satisfaction or compensation for a wrong or injury.
39. To take the tenth part of or to destroy a considerable proportion of a group.
40. An instrument used to regulate an electric current.
41. Knowing all things. Infinitely wise. One who is possessed of universal knowledge.
42. To curse or treat basely. Used in imprecations, frequently with little meaning.
43. A cat-like animal resembling the leopard found in India, Persia, and Africa.
44. A very large and strong animal—especially one mentioned in the Bible.
45. A bay window, particularly one which projects from the face of a wall.
46. One of the great stones or boulders used in prehistoric monuments.
47. A soft, white substance that forms a protecting sheath about the centre of medullated nerve fiber.
48. An ancient manner of writing. Ancient writings, or the study of such writings.
49. The branch of surgery that treats of adding artificial parts to the body to replace natural parts which are wanting.
50. The dried tubers of various orchids, used for food, like tapioca.

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MENTIMETER NO. 15: Word Discrimination.

Any real difference named by the candidate between the two words to be compared should be given credit *whether it appears in the following list or not.* The list merely points out some of the outstanding differences between the words of each pair, but does not attempt to list all of the possible differences. Any difference mentioned by the candidate which is confirmed by any standard dictionary should be sufficient to give full credit.

1.	A bird lives in the air	A fish lives in the water
	flies	swims
	has feathers	has scales
2.	A snake is long	A fly is short
	is a reptile	is an insect
	crawls	flies
	has no wings or legs	has wings and legs
3.	A pen writes only when it has ink	A pencil writes without ink
	is made of steel or hard metal	is made of lead or soft material
	does not have to be sharpened	has to be sharpened
4.	An eagle flies very high and long distances	A chicken flies very low and but a short distance
	is wild	is domestic
	is not good for food	is good for food
5.	A book usually has a hard cover	A magazine has a paper cover
	is usually one story, by one author	is several stories, by different people
	is published once	is published periodically
6.	An orange has a reddish yellow color	A lemon has a bright yellow colour
	is spherical in shape	is oblong in shape
	is usually larger than a lemon	is usually smaller than an orange
	is usually sweet	is usually sour
7.	A teacher works in a school	A preacher works in a church
	usually teaches children	usually addresses grown-ups
	deals primarily with academic subjects	deals primarily with religious subjects
8.	Luck comes to a person by chance	Pluck is part of a person's character
	is a temporary advantage	is a permanent advantage
	comes to everyone	is characteristic of a few

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9. Stone is a natural product, made of mineral matter
is used for buildings
is thick and coarse
: China is made artificially of fine earth or clay
is used for dishes
is thin and fragile

10. A balloon depends on the wind for motion
has a large gas bag
moves slowly
: An airplane is run by a motor
has no gas bag
moves rapidly

11. To plod is to work or travel slowly but steadily
is to toil, to drudge
: To plot is to scheme or plan, usually for evil to someone else
is to conspire, to intrigue

12. To wither is to fade, to lose freshness
is to languish
flowers wither
: To shrivel is to dry up, to draw into wrinkles
is to shrink
vegetables shrivel

13. To surprise is to come upon one unawares, or unexpectedly
: To astonish is to strike one with sudden wonder or amazement

14. Rash means overhasty in counsel or action
means undertaking a matter without sufficient reflection
: Reckless means careless, utterly heedless of consequences
means indifferent or thoughtless

15. Lonely is to be without desired companions
: Solitary is to be absolutely alone
remote from society

16. Sorrow is pain of mind from loss or disappointment
is deep seated, lasting
: Sadness is being downcast or unhappy
may be transient, passing

17. Plutocrat is one whose wealth gives him power or influence
: Autocrat is an absolute sovereign, having usually inherited authority

18. A rascal is a mean, tricky person
: A rogue is an idle, mischievous person

19. To plunder is to take goods by force, to pillage
: To devastate is to lay waste, to desolate, to ravage

20. To relinquish is to abandon the thing which has been possessed, or the object of pursuit
: To resign is to formally return or give up an office, to submit, to acquiesce, to abdicate

21. Shrewd means artful, malicious, cunning, of less dignity than sagacious
: Sagacious means one of keen penetration and judgment, one with a comprehensive as well a penetrating mind

22. Dormant means sleeping, not in action
: Quiescent means resting, in a state of repose

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23. Reconstruction means to form anew, means to build over again, deals more largely with material things : Rehabilitation means to invest again with some right or dignity, deals largely with mental and spiritual things

24. Reparation means restoration, renewing: repairing damage done, has more of the idea of replacing things destroyed : Indemnity means immunity from loss or damage, remuneration for injury, has more of the idea of paying for things destroyed

MENTIMETER NO. 16: Naming Opposites.

Except in special cases indicated below, no credit should be allowed for adding "not" or "un" or any other negative prefix to the printed word. An entirely different word should be used as the opposite of the printed word. Those words printed in parentheses in the following list should not be given credit as being satisfactory opposites. Words not printed below but as satisfactory opposites as those printed should be given full credit, while words as unsatisfactory as those printed in parentheses should not be given credit.

1. bad, poor (not good)
2. poor, needy, indigent
3. big, large, great (tall)
4. old, ancient
5. easy, soft
6. light (white)
7. clean, pure
8. well, healthy
9. south
10. full, filled
11. pull
12. right, correct
13. end, ending
14. wide
15. evening, afternoon (night)
16. somewhere, everywhere
17. fresh
18. idle
19. to sink (to swim)
20. rough, ragged
21. tame, domestic
22. weakness
23. guilty
24. ignorance, stupidity
25. negative, uncertain
26. superior
27. modern, new
28. cause
29. generous, liberal
30. concrete, specific

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31. justice, impartiality
32. dilatory, sluggish
33. extravagant, wasteful, uneconomical
34. genuine, real
35. depression, melancholy
36. delay, impede, hamper
37. confident, bold, immodest
38. heterogeneous
39. cowardly, irresolute, fearful
40. slanderous, scurrilous, vilifying

MENTIMETER NO. 17: Spelling Tests

The word lists themselves furnish the correct answers and therefore no further set of answers is needed here. See pages 199–200 for the lists.

MENTIMETER NO. 18: Range of Information

1. COW
2. CLUBS
3. CIGARETTE
4. CARPENTER
5. GREEN
6. AUTOMOBILES
7. DOG
8. ACTRESS
9. HUYLER
10. 1861
11. COUNTY
12. PAINTER
13. MOTORCYCLE
14. NOVELIST
15. FILING-CASE
16. DISTANCE
17. LEG
18. REEFS
19. WATER
20. STOWE
21. STATESMAN
22. POUGHKEEPSIE
23. LAW
24. TWO
25. DICKENS
26. ENGLAND
27. BIRD
28. ATHLETICS
29. DRINK
30. INK
31. FRUIT
32. ISOSCELES
33. 1066
34. HEART
35. PLANT
36. KOREA
37. OXYGEN
38. MUSIC
39. CLOTH
40. ANIMAL

MENTIMETER NO. 19: Reading Vocabulary.

1. BODY, TOOL
2. ANIMAL
3. CLOTHES
4. COLOUR
5. BIBD
6. CLOTHES
7. ANIMAL, BODY
8. TOOL, FISH
9. BODY
10. TOOL

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11. BIRD
12. COLOUR
13. FISH
14. WAR
15. TIME
16. WAR
17. ANIMAL
18. FISH
19. TIME
20. CLOTHES
21. WAR
22. BODY
23. COLOR
24. BIRD
25. FISH
26. TOOL
27. TIME
28. ANIMAL
29. COLOUR
30. WAR
31. TIME
32. CLOTHES
33. BODY
34. BIRD
35. FISH
36. BODY
37. WAR
38. TOOL
39. ANIMAL
40. BIRD

MENTIMETER NO. 20: Reading, Directions.

1. The name should be written *on the line.*
2. There should be a cross or an x *in the square.*
3. There should be a cross or an x in the circle and a dot or period in the square.
4. There should be a 1 under the letter M and a 2 under the letter W, in the list of capital letters beginning A, N, etc.
5. The word "Yes" should be written *on the dotted line.*
6. The word "in" should be crossed out and the word "and" should have two lines or circles around it.
7. The word "seven" or the figure 7 should be written on the blank at the left, "twelve" or 12 on the middle blank, and "one hundred" or 100 on the blank at the right.
8. "Ten" or 10 should be written in the square on the left, a small circle should be written in the second square, and the letter "C" in the triangle at the right.
9. There should be a line drawn under the word "Peck."
10. The word "thousand" or 1000 should be written in the circle.
11. The square in front of the word "diminished" should have a check mark or cross on it.
12. There should be a line under the word "Face."

MENTIMETER NO. 21: Reading, Interpretation.

Answers must show conclusively that the questions and the sentences answering them were read and understood by the candidate.

1. Boys.
2. In the houes.

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3. Girls.
4. On farms, in stores, mines, and factories.
5. In the things they enjoy and in the things they are able to do.
6. Wheat, corn, and cattle.
7. To make clothing to keep us warm.
8. To protect us from rain and snow.
9. Differences between people.
10. Because the world has all sorts of work that must be done, or it makes possible the adjustment of people to the different tasks to be done.
11. Much of it would be poorly done.
12. The difficulty of the task.
13. Discontentment and unhappiness.
14. "Expeditiously" suggests a lack of economy in time and money.
15. Intellectual measurements.
16. The consummation of the science of personnel engineering.

MENTIMETER NO. 22: Disarranged Sentences.

The most frequent arrangement of the words in each sentence is indicated below by the last word. Any other arrangement of these words which produces a perfectly logical and grammatical sentence may be accepted. Very few sentences will be found that are not already provided for in the concluding words listed below.

1. WHITE.
2. ROBIN. BIRD.
3. WATER.
4. HOUSES.
5. WITH.
6. WEST.
7. COUNTRY.
8. COLDEST.
9. FOOD.
10. EARTH.
11. FOOD. VALUABLE.
12. TREES.
13. GERMANY. ENGLAND. FRANCE.
14. PUNISHED.
15. OCEAN.
16. MISTAKES.
17. NIGHTS. SEEN.
18. CLOTHING. USEFUL.
19. DEBATERS.
20. WARFARE. POISONOUS.
21. DEGRADING. UNFORTUNATE.
22. CRIMES. BIGAMY. PERJURY.
23. PSYCHOLOGISTS.
24. STEALING.
25. FACT. OBSERVED. APPLIED.

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MENTIMETER NO. 23: Completion of Sentences.

It is impossible for any one to make out a complete list of all the possible completions of any group of twenty sentences such as those included in this test. The list of completions given below is therefore merely suggestive of the perfect sentences which may be made and is not intended in any way to be exhaustive. Anything which is as good as the completion listed below should be given full credit. Anything which is not so satisfactory should not be given credit.

1. *Is* or *was*.
2. *To*.
3. *Gave*, or *gives*.
4. *Girl* or *child* in the first blank, and *to* in the second blank.
5. *And* in the first blank, with *dogs* in the second blank.
6. *Have*, *make* or *gain*.
7. *Not* or *never* in the first blank, with *parents*, *friends*, or *sister* in the second blank.
8. *Boy*, *man* or *child* in the first blank, with *fell* in the second blank.
9. *Is* or *was* in the first blank, with *to* in the second blank, and *windy* in the third blank.
10. *Succeeds* or *can*.
11. *Animal* in the first blank, *his* or *its* in the second blank, and *size* in the third blank.
12. *Man* in the first blank, with *carried* or *carries* in the second blank, and *wore* or *wears* in the third blank.
13. *On* in the first blank, *quenches* in the second blank, *drink* in the third blank, and *cold* or *pure* in the fourth blank.
14. *Patriotism* in the first blank, *waving* or *carrying* in the second blank, *come* or *go* in the third blank, and *marching* in the fourth blank.
15. *That* or *which* in the first blank, *worth* in the second blank, *well* in the third blank, *doing* in the fourth blank.
16. *Does* or *can* in the first blank, *give* in the second blank, *every* in the third blank.
17. *When* in the first blank, *better* in the second blank, *practice* in the third blank, *at* in the fourth blank, *wrong* in the fifth blank, *doing* in the sixth blank.
18. *Which* or *that* in the first blank, *cause* in the second blank, *are* in the third blank, and *very* or *most* in the fifth blank.
19. *To* in the first blank, *when* in the second blank, *thirsty* in the third blank, and *great* or *real* in the fourth blank.
20. *Whether* in the first blank, *likes*, *desires*, or *welcomes* in the second blank, *or* in the third blank, *one* in the fourth blank, *not* in the fifth blank, *as* in the sixth blank, *insult* in the seventh blank.

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MENTIMETER NO. 24: Analogies or Mixed Relations.

As with several of the other lists of answers, no attempt is made here to give an exhaustive list of the correct solutions. The words which appear below are standard. Anything as good as this standard list should be accepted while anything inferior to the printed solutions should not be given credit.

1. Dogs
2. Far, distant
3. Foot
4. Cat's
5. Hot, warm, heat
6. Swims, swim
7. Hen
8. Drink
9. School, classroom
10. Her
11. Law
12. Colt, foal
13. Bought
14. Painting, picture, portrait
15. Sheep, ram
16. Floor
17. Bird, birds, fowl
18. Chauffeur
19. Was, were, been
20. School, shoal
21. Night
22. Risen
23. Drake
24. Sheep, animal, beast
25. Women's
26. Give, donate, buy, return
27. Aviatrices
28. Criterion
29. Joneses'
30. Esoteric

MENTIMETER NO. 25: Handwriting.

The reader will be able to count the number of letters written per minute and thereby obtain the score in this test without any key. For the quality of the results of such a test the reader will compare the handwriting of each candidate with the samples printed on page 239.

MENTIMETER NO. 26: English Composition.

This test, like the test for handwriting quality, is a test of the quality of products produced by the candidates rather than of the difficulty of problems solved. Therefore, no set of correct answers is necessary. The quality of the candidate's composition should be compared directly with the quality of the printed samples appearing on pages 242 to 244.

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MENTIMETER NO. 27: Poetic Discrimination.

The correct order as determined by the judgments of scores of capable judges of English Poetry is as follows:

	Best	Middle	Poorest
In Set No. 1	Z	Y	X
In Set No. 2	X	Y	Z
In Set No. 3	Z	X	Y
In Set No. 4	Y	X	Z
In Set No. 5	Y	Z	X
In Set No. 6	Y	Z	X

MENTIMETER NO. 28: Arithmetic Reasoning.

In giving the correct answers below each figure has attached to it the word indicating the commodity concerned. No answer should be considered incorrect, however, because it omits the words "dollars," "lemons" or "men."

1. 8 men
2. 12 dollars
3. 9 nickels
4. 5 benches
5. 8 cents
6. 23 cents
7. 16 lemons
8. 3373 quarts
9. 500 pounds
10. 51 cents
11. 750 people
12. 22 tons
13. $4.80
14. $1575.00

MENTIMETER NO. 29: Practical Judgment Test.

1. Get a drink of water.
2. It tastes good.
3. Wear a raincoat.
4. Ring the alarm and try to put out the fire.
5. Ask the person's pardon.
6. The frost has killed them.
7. To protect them from the colder weather.
8. At the beach of a summer resort.
9. Try to make time by hurrying.
10. To display the flag and inspire patriotism.
11. Water always becomes solid at low temperatures.
12. Nail a piece of tin over it.
13. It is an easily digested and wholesome food.
14. An incandescent electric bulb.
15. To create a demand for special brands.
16. So that their strength may be utilized.

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17. The low temperature keeps it fresh.
18. One could jump from one-story buildings.
19. Discover and remove the cause of its crying.
20. It has fewer impurities in it.

21. To avoid making the city smoky.
22. To remove the electricity from the air.
23. High and rapidly.
24. To help one decide where to read.

MENTIMETER NO. 30: Logical Conclusions Test

1. Older than James.
2. Older than Mary.
3. Shorter than Dot.
4. Not heavier than May.
5. Slower than William.
6. Smarter than Bertha.
7. Not as rich as Mr. Jones.
8. Not noisier than Robert.
9. Less rapidly than Henry.
10. Not warmer than Thursday.
11. Not as frugal as Mrs. Brown.
12. Not larger than the second.

THE END

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